OFFSHORE SOFTWARE DEVELOPMENT – STRATEGIES AND PRACTICES

MS Survey

Nayyar Iqbal
03-9171

National University of Computer and Emerging Sciences, Lahore, Pakistan

OFFSHORE SOFTWARE DEVELOPMENT – STRATEGIES AND PRACTICES

MS Survey

Submitted in Partial Fulfillment
of the Requirements for the
Degree of

Master of Science (Software Project Management)

at the

National University of Computer & Emerging Sciences, Lahore, Pakistan

By

Nayyar Iqbal

(03-9171)

June 2005

Approved by:

Advisor

_____

Mr. Waqas Zyad
Assistant Professor
National University of Computer and Emerging Sciences, Lahore, Pakistan

Vita

Mr. Nayyar Iqbal was born in Rawalpindi, Pakistan on September 21, 1979. He received a Bachelor of Engineering in Information Technology from Hamdard University, Islamabad in year 2003. He has worked as a software engineer in Innovative Research e-Solutions, Islamabad for two years and now working as Project Manager in the same organization. The research in this dissertation was carried out from January 2005 to June 2005.

His other interests include reading books and playing computer games.

Acknowledgements

All the praise and appreciation to ALLAH, the Creator. Only HE possesses the ultimate knowledge. HE provides the endeavor, wisdom, will and fervor to delve into the deep sea of knowledge.

Salaam on Prophet MUHAMMAD (peace be upon him), who is the ‘City of Knowledge’. He guided us through the path and aggravated us to seek knowledge.

My sincerest thanks are to Mr. Waqas Zyad for his constant support and esteemed supervision in regard of this research work. His guidance and support encouraged me throughout my research work. He vigorously reviewed the research work and papers and provided useful suggestions. I really appreciate his personal attention in the project and giving me time for meeting whenever it was required. I learnt a lot from my work experience with him.

Finally, I offer my gratitude to my parents and sisters for their relentless support and prayers during uncertainty and tough times.

Dedication

This dissertation is dedicated to my Parents.
As I would never have achieved anything,
without their incessant support and conviction.

It is also dedicated to
Ch. Tariq Pervaiz Randhawa
SOMEONE to be REMEMBERED . . . .

Table of Contents

List of Figures

List of Tables

ABSTRACT

Offshore software development provides the access to world class solutions from areas of the world where operating costs are much lower than the developed countries. The time zone differences are a big help, too. For example, the average difference of 10 hours between the U.S. and South Asia is perfect for accelerated and 'round-the-clock' problem solving. A client reporting a bug from the U.S. at the end of the day could get the fix from South Asia by the next morning. But the basic question that comes into the mind that 'Is it as simple as that?' the answer is 'No, it's not as simple as that.' There are several issues involved in making the offshore software development option a successful one.

The growing acceptance of offshore delivery has led enterprises to move beyond low skill and labor intensive tasks and to rely on offshore suppliers to deliver complex custom applications and advanced web-based solutions. In addition to cost savings, companies are realizing more benefits from offshore software development, like faster time to market, focus on core activities, access critical technology skills and enhanced quality standards. Another prominent reason for offshore software development is the shortage of IT talent in some of the developed countries. Apart from this, globalization is also playing its role. Software globalization has resulted in dispersal of software development activities among developing nations and secondly software development moving away from the traditional co-located form to a form in which global virtual teams collaborate across national borders. Global software development projects use virtual teams, which are primarily linked through computer and telecommunication technologies across national boundaries. Offshore software development has its limitations and risks associate with it and if not dealt properly can cause big failures.

The survey of local software development organizations has revealed the current status of offshore software development. Overall business situation is satisfactory but a deep analysis shows that there are weaknesses in the current practices. Some basic project management and process management activities have been ignored which may yield undesirable results in the long run. However, comparison of this survey with some prior surveys shows that there are trends of improvement. Offshore software development can contribute in the development of our country.

Chapter 1

INTRODUCTION AND PROBLEM ELABORATION

1.1 Background and Motivation

Offshore software development has become an increasingly common approach for organizations over the last decade, including cross-border software outsourcing. Despite some success, a number of issues remain problematic and need to be resolved. Initially outsourcing software development to offshore suppliers was seen as a cost-cutting approach used by a few big U.S. companies to offload mainframe maintenance and other assorted IT grunt work. However now, fast-growing Internet startups, midsize businesses, and dozens of major companies are using offshore suppliers not just for maintenance and reengineering, but also to develop sophisticated new applications and web enablement.

The biggest reason is the shortage of IT talent in some of the world's largest economies. A recent study by the Information Technology Association of America finds a national IT workforce of 10.4 million in the US. Add to this total an additional 900,000 workers that companies say they hope to hire this year. Of this total, 425,000 positions will go unfilled because of a lack of applicants with the requisite technical and non-technical skills. According to the companies, it is almost impossible to find enough good developers - and even the not-so good ones cost a fortune. In contrast, areas such as South Asia and Eastern Europe have access to thousands of software developers, many with Java and other Internet related skills, available for $20 to $40 an hour. In India alone, there are 1,832 educational institutions and polytechnics training close to 110,000 computer professionals each year. In today's competitive marketplace, escalating costs of software development and shortage of skilled software professionals are important issues of concern.

Offshore software development has emerged to be a viable alternative. But what exactly does this term mean? It means software development carried out in countries that are strategically well positioned to develop quality software apart from giving you a decisive cost advantage.

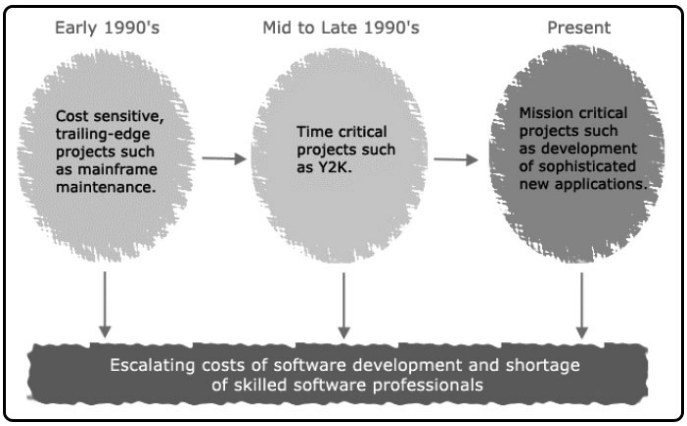

Figure 1. Emergence of offshore development trend in software industry.

While looking at the various risks involved in offshore software development approach, it is quite evident that offshore programming and remote programming methodologies run the normal risks of any offshore outsourcing projects in terms of improper specifications, flawed change request procedures, improper communication protocols and poor quality assurance and testing practices. These flaws are highlighted in offshore programming to a great degree and should be addressed by the buyer and the supplier in the initial stages of agreement. The other risks inherent to offshore development are inability to choose appropriate vendors, cultural differences and communication issues. Like any other situation, the prime focus of offshore development should be to avoid a disparity between expectations and deliverables. There can be problems with communication and understanding of requirements. It is even more important to document the requirements clearly, so that what is expected from the service provider is what is delivered. In addition to communication problems, it is very important for offshore service providers to understand their client's marketplaces and cultures.

Moreover, offshore software development requires a methodology quite different from local software development. For example, an onsite software development team can resolve critical issues by meeting in a conference room. When teams are diverse, then we need to create a process that automatically keeps everyone in the loop. Modern technology has offered several alternatives for effective communication among remote teams, e.g. conference calls, telephone, email, message boards, web-based project reviews etc.

1.2 Research Objectives

This research work has been a journey of discovery for me. It has been a discovery of my profession and its place in the larger context of the industry to which it belongs. The objective of this survey is to appraise different issues related with offshore software development including top management support, cultural differences, requirements management and change management. Moreover some client related issues including client handling and client education are also incorporated. Different models proposed and used for offshore software development are also discussed with their imminent impacts. Potential overheads of offshore software development are also mentioned.

Throughout literature survey different strategies and practices have been suggested to evade the above mentioned problems. Furthermore, a local market survey has been accomplished to observe the current practices and problems faced by local software businesses.

1.3 Organization of Survey

The whole survey document is alienated into 6 different chapters. Each chapter comprises of several sub sections for to cover various related issues [103-108]. The detailed organization of this manuscript is as follows:

Chapter 1 elaborates the background of the whole survey research work. It also states the objective of the survey. Finally the organization of the survey research work document has been discussed in detail.

Chapter 2 discusses the prior work done in software engineering and software project management literature related to the field of offshore software development. This chapter covers the inspirations behind offshore software development, offshore development maturity, the emergence of virtual teams, different types of client-vendor relationships and their implications. It also covers the general implications of offshore software development, several hidden costs related with offshore software development and certain limitations associated with offshore software development.

Chapter 3 provides an overview of the current business context of offshore software development. It also describes current trends in the field of offshore development, execution models for offshore software development, business models for offshore software development and resource based view of offshore software development.

Chapter 4 focuses on the methodology of the survey that was conducted in the local software industry. This chapter briefly discusses the data collection procedure and description of data. The summary of survey results is also provided in this chapter.

Chapter 5 presents the discussion on results of the survey. A comprehensive analysis of the whole survey has been stated in this chapter. Moreover, this chapter also puts some light on the recommendations drawn in the light of survey analysis.

Chapter 6 concludes the whole study keeping in view the limitations linked to the research area. This chapter ends up with some directions for the future work.

Chapter 2

PRIOR LITERATURE

2.1 Offshore Software Development

Software outsourcing can be further sub categorized into onshore and offshore scenarios. Theoretically offshore software development is defined as to be based or operating abroad in places where the tax system is more advantageous than that of the home country [1]. Offshore software development can be considered from customer's perspective or from the developer's perspective. However in this survey document, the primary focus on offshore software development issues would be from developer's perspective, but both the perceptions have been addressed.

Offshore development is a rapidly growing practice in world economy because companies are under pressure to get products out or adjust their technologies at a rapid pace, without compromising their quality standards and internal resources. For this reason, most of the middle range firms and even smaller scale companies particularly from the developing countries are stirring towards the offshore development [1].

	1999-2000	2000-2001	2001-2002
Onsite	57	56	47
Offshore	35	39	49
Products and unclassified	8	5	4

Figure 2. Indian national trends in export delivery models (All figures are percentages taken from Nasscom, New Delhi, 2002)

The prime focus of customer is always on cutting expenses. However, the level of required work still needs to be maintained to generate revenue and 75% reduction in operational cost has been observed.

2.2 Inspirations Behind Offshore Software Development

For many business and information technology decision makers, the term offshore development brings to mind a world where companies in advanced economies contract out low skill, labor intensive tasks to service suppliers in developing countries to reduce costs. However, although the fundamental value proposition of offshore software development is based on cost management, it has evolved into a highly diverse and dynamic IT service delivery model that spans the application life cycle from design to development to ongoing maintenance [2].

Area	Percentage of total exported IT services
IT-enabled services	24.11
Application software	20.42
System software	12.51
Application reengineering	7.88
E-commerce/Web applications	7.47
CAD/CAM/GIS	7.44
Consultancy services	7.03
Communication software	5.43
ERP/client-server	4.85
VLSI and embedded software	2.86

Figure 3. Top IT Export Areas (Based on figures from growth of IT Industry 2001-2002 Software Technology Parks, Hyderabad, 2002)

The growing acceptance of offshore delivery has led enterprises to move beyond low skill and labor intensive tasks and to rely on offshore suppliers to deliver complex custom applications and advanced web-based solutions. In addition to cost savings, companies are realizing the following benefits from offshore development;

1. Faster time to market
2. Focus on core activities
3. Access critical technology skills
4. Improved quality

However, realizing these benefits is not without its challenges. Language and cultural differences can get in the way of understanding and collaboration, both of which are essential elements in any software development project. In addition, many offshore suppliers, skilled in the technical phases of the application life cycle, lack the industry specific business process expertise required to turn

imprecise requirements into functional designs and user friendly applications. Moreover, company executives and stakeholders are often wary of offshore development approach, regardless of where suppliers are located. Fortunately, the benefits of offshore software development do not have to be compensated by cultural misapprehensions and internal distractions. As with any form of offshore development, there are best practices that, when applied, help overcome the challenges. Many of these practices are not different from ones associated with other types of offshore development, whereas others are unique to managing software projects across different cultures and multiple time zones.

2.3 Offshore Software Development Maturity

Initially offshore software development was seen as a cost cutting approach used by a few big U.S. companies to divest mainframe maintenance and other assorted IT grunt work. However now, fast growing Internet startups, midsize businesses, and dozens of major companies are using offshore suppliers not just for maintenance and reengineering but also to develop sophisticated new applications and web development.

The leading motive is the lack of IT talent in some of the developed regions of the world. According to the companies, it is almost impossible to find enough good developers and even the not so good ones cost a fortune. In contrast, under developed countries such as Pakistan, India, China and Eastern Europe have access to thousands of software developers, many with Java and other Internet-related skills, available for $20 to $40 an hour. In India alone, there are 1,832 educational institutions and polytechnics training close to 110,000 computer professionals each year. In today's competitive marketplace, escalating costs of software development and shortage of skilled software professionals are important issues of concern. Reputed global companies such as Intel, American Express, Aetna, U.S. Healthcare, Compaq, General Motors, Home Depot, IBM, Microsoft, Motorola, Shell, Sprint, and 3M have set up their own offshore software development centers or entered into strategic alliances with offshore software companies.

2.4 Emergence of Virtual Teams

Software globalization has resulted in dispersal of software development activities to budding and developing nations and secondly software development moving away from the traditional co-located form to a form in which global virtual teams collaborate across national borders [4]. Large telecommunications and software companies have numerous software development groups residing in

different countries around the world. The different groups work in a virtual setting, with members of the software development teams, interacting and communicating their work.

Apart from the low cost advantage of developing software in developing countries, organizations use geographically distributed software development groups in 'follow the sun approach' to enable almost 24-hour software development cycle [4]. Organizations also outsource their software development activities to contractors outside their home countries [5]. For example, India has a dominant offshore software development industry, which accounts for more than $6.4 billion in software export. This industry has more than 900 software export firms and employs approximately 415,000 software professionals [6].

A software engineering project involves a number of different activities such as requirements specifications, analysis, design, coding, testing and implementation. The requirements definition phase of the software development life cycle is often cited as the most critical of the phases [7]. This is due to the fact that mistakes made during the requirements analysis phase cascade into the latter phases of the software development life cycle including functional specifications, code development, and implementation. Previous research has shown that mistakes made during the requirements phase can cost as much as hundred times more than a coding error [8]. Thus, it is critical to have an exceedingly well defined requirements document in order to ensure a successful project that meets the three metrics of on time, within budget, and in conformance to requirements.

Global software development projects use virtual teams, which are primarily linked through computer and telecommunications technologies across national boundaries. Global virtual teams rarely meet in a face to face context and thus face challenging problems not associated with traditional co-located teams. It is argued that if virtual teams are used in the requirements definition stage, the teams can exploit overnight gain effect due to the time difference between the locations where the teams are deployed which will reduce the cycle-time [9]. It is also reported that apart from immediate gain effect, the teams can leverage on the expertise of the different global virtual teams, in developing robust requirements artifacts. Moreover, projects that are intended to be used in a global scale, cross functional teams from different parts of the world can capture the international requirements more aptly at the very beginning of the software development life cycle [9].

In order to analyze the performance of global virtual teams, it is necessary to develop a theoretical framework for analyzing the team performance. Global virtual teams are dispersed across organizational, space or time boundaries and are often cross functional in nature [9]. The development teams working in a global context has some advantages such as the ten and a half hour time difference between U.S./Canada and South Asia, which can facilitate a near

continuous software development cycle. However, it also has its share of disadvantages such as overcoming language and cultural barriers, coordination problems, and technology infrastructure problems [10]. It is important for organizations to find out the effectiveness of their global software development effort and the variables, which affect the effectiveness of these projects.

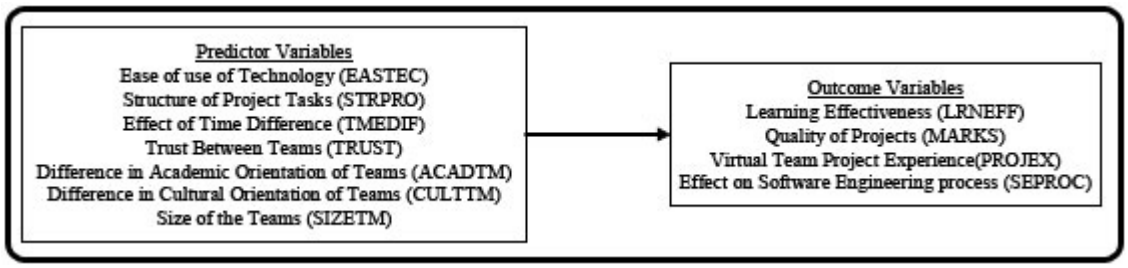

Figure 4. Model for assessing the performance of global virtual team projects.

Country and cultural difference, is one of the reasons behind having teams from two very different countries. In particular, the interaction between India and Canada allowed us to explore the impact of cultural factors such as business environment, work ethic, preference for a method of communication, legal requirements, and leadership whilst maintaining a common language of English.

Geographical difference is another reason behind the choice of such diverse groups. In particular, India and Canada are located in opposite hemispheres of the world and feature a 10 hour and 30 minute difference between them. Thus, it was exceedingly unlikely that any of the teams would be able to co-locate.

The use of virtual teams in the construction of industrial software is becoming more and more commonplace as corporations seek to take advantage of lower costs and to utilize a ‘follow the sun approach’ to software development. Requirements definition phase of the project, the phase is very critical for the quality of the software product and requires effective communication between the business process teams and systems analysis team. Realities of global software development environment indicates that ease of use of technology, trust between the teams and well defined task structure influence positively the efficiency, effectiveness, and satisfaction level of global virtual teams. These parameters can be used by organizations to improve the outcome of global virtual team projects.

Organizations are trying to move their offshore development relationship up the value chain and include all phases of system development, they incur costs and risks [5].

2.5 Client-Vendor Relationships in Offshore Software Development

While still a relatively recent phenomenon, IT outsourcing has evolved through several phases and the literature has adopted a variety of theoretical lenses to explain the phenomenon. The majority of studies on IT outsourcing presume that client firms seeking IT services act independently of each other, while IT vendors do the same. Thus the assumed relationship between client firm and IT vendor has been a simple 'dyadic' one. Despite the emergence of new terminology to describe different characteristics of these relationships such as long term strategic alliances, partnership, rather than simple market based contracts the fact is that concepts such as alliance or partnership have been little used to describe the relationships that may exist among client firms seeking IT services or among IT vendors themselves [11]. As discussed below, the terms such as partnership or strategic alliance have only been used to characterize simple, dyadic outsourcing relationships between a single client and offshore software developer. Furthermore, these terms are heavily used today and have recently been shown to be abused by using them to describe offshore development relationships which have no true partnership characteristics, such as risk sharing [12, 13].

Two recent shifts in the business world prompt the need to develop a more comprehensive vocabulary and framework for understanding offshore software development relationships. The first is the observed shift toward more complex offshore development arrangements, defined here as relationships involving more than two parties. According to an InformationWeek survey of IT managers 92% of firms were using multiple IT vendors to assist them with their work; only 8% were using just a single IT vendor [14]. One example is the announcement by Bell South Telecommunications that it had entered into a ten year offshore development arrangement with Andersen Consulting and EDS to provide application development, operations support, network planning, and administration [15].

The second shift is the greater frequency of cooperative arrangements among client or vendor firms. This includes such arrangements as joint ventures, strategic marketing alliances, and mergers and acquisitions. While the strategic management and R&D literature has paid increasing attention to the role of such networks in enabling firms to achieve their objectives, the IT literature has minimized the importance of such collaborative arrangements [16]. Increasingly, however, more complex or collaborative relationships are necessary, involving multiple offshore developers and possibly working to serve multiple clients under the terms of the same contract or same relationship. It is believed that such collaborative relationships are increasingly necessary as client firms prefer to develop solutions characterized by 'best of breed' expertise, rather than reliance on a single, comprehensive vendor solution.

2.6 Types of Offshore Relationships

There are four main types of relationships that can exist between vendor and offshore developer. The details of these relationship types are stated as follows and they should be viewed in context of large IT projects.

2.6.1 Simple Offshore Relationships

A one-to-one relationship is straightforward, and has been assumed in most of the researches. The client relies on a single offshore software developer in satisfying all of its development needs, which might range from a simple (i.e. accounts payable system) to a more sophisticate task (i.e. ERP Implementation skills). Most previous academic studies in offshore software development, particularly those that examined the contractual risks from the transaction costs economics perspective, have treated this one-to-one relationship as the default. One reason for this bias has been that for the last several years there have been only a few offshore software service providers (mostly by India) dominating the market. These offshore software service providers have been equipped with both the advantages of market power and knowledge expertise, thus enabling them to provide their clients with a full menu of IT services. Such dominance by a few huge vendors had made it difficult for smaller vendors to compete; the latter often focus on specific industries (e.g. health care) or in specialized technology niches (e.g. web page design). More important, these smaller vendors had little opportunity to cooperate with the large offshore service providers. These types of relationships are also termed as one client, one vendor relationships.

2.6.2 Multi-vendor Offshore Relationships

A one-to-many relationship indicates that one client uses multiple offshore service providers to achieve its objectives, and that division of labor is jointly negotiated and understood by all parties to the agreement. For instance, in 1989 Kodak fully leveraged the expertise of three offshore development service providers by allowing them to concentrate on their core IT services. In 1994, British Petroleum's Exploration division entered into a similar arrangement with three offshore service providers to provide services in data center management, application development, and network installation and support [16]. Recently, Chevron's IT division signed a deal, valued at about $450 million, with three offshore development service providers to make a best use of each firm’s specialty. Table 1 provides several very recent examples of firms entering into multi-vendor offshore development relationships. In most cases, such a multi-vendor alliance places a heavy coordination burden on each member, as discussed below. These types of relationships are usually known as one client, many vendors relationships.

Client Name	Vendor Names	Term (years)	Dollar Value
Bell South Telecommuni-cations	EDS, Andersen Consulting	10 years	$5 B (est.)
IRS	CSC, IBM, , SAIC, Unisys, and Northrop Grumman	N.A. (pending)	$ 8 B (est.)
DuPont (Chemicals)	CSC, Andersen Consulting	NA	$4 B
Ryder Systems	Andersen Consulting IBM	NA	$ 1.4 B
Chevron	EDS GTE SPRINT	5 years	$450 M
NASA	KPMG CSC	15 years	$ 186M
Department of Justice	Wang, SAIC Indus, ComTeq	5 years	$ 100M

Table 1. List of recent multi-vendor alliances.

2.6.3 Co-offshore Relationships

The co-offshore relationship is defined as many-to-one alliance where several clients contract with a single IT vendor for services. Such buyer alliances are common for other purchase decisions and have been the focus of research in other business disciplines such as marketing and management. Although some drawbacks exist, three major advantages have been identified: risk sharing and reduction, increased bargaining power and buyer economies of scale. Firms may elect to pool their needs and resources for purposes of hiring an offshore software service provider. This has most often been observed for new system development, when firms seek a common software solution or common infrastructure to support business transactions. Such co-offshore alliance enables two or more firms to contract for joint delivery of IT services from a single offshore developer firm. An example of several independent hospitals joining together to contract with an offshore systems integrator to develop custom software, has been stated in literature [20]. The stated objectives for collaborating on such an effort were savings in time and money for the seven hospitals participating in the alliance. In principle, similar buyer alliances may also occur when firms contract for ongoing IT support services such as data center, LAN support and help desk, yet the evidence for such buyer alliances has been scant in the literature. Such relationships are also called many clients, one vendor relationships.

2.6.4 Complex Offshore Relationships

The term ‘complex offshore’ relationship is used to characterize a many-to-many relationship that features both multiple clients and vendors in the same offshore development contract. This can be viewed as a combination of both multi-vendor and co-sourcing relationships. The recent contract negotiated among seven insurance companies, Andersen Consulting, and GE Capital Technology Management Services provides an excellent example for this type of relationship. According to [24], Andersen Consulting teamed with GE Capital Technology Management Services to deliver a comprehensive IT solution to the seven insurers, yet where both vendor firms are equal partners in the contract.

According to the press release provided by Technology Partners, Inc.: Andersen Consulting managed the overall delivery of information technology and application services and GE Capital provided infrastructure services, including 24-hour-a-day data center operations; systems administration and maintenance of mid-frame environments; voice and data network management; and desktop computing and help desk support. These types of relationships are normally termed as many clients, many vendors relationships.

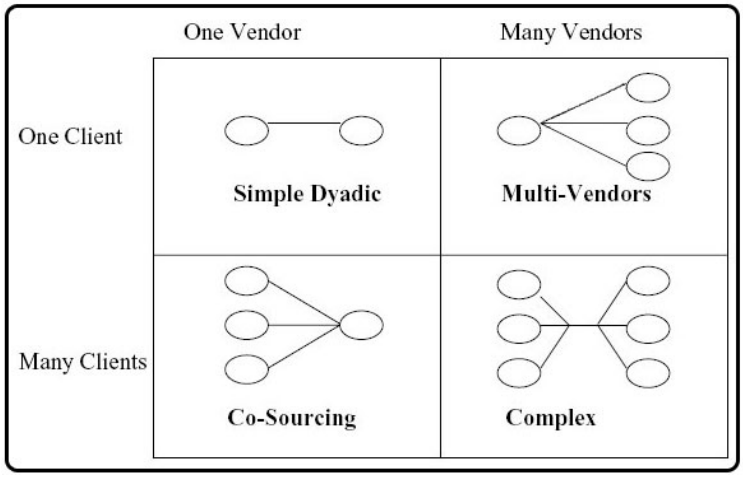

Figure 5. Taxonomy of four classes of offshore development relationships.

2.7 Comparison of Dyadic Offshore Relationships with Multi-vendor Relationships

Moving horizontally across Figure 5 implies that firms seek offshore development relationships that feature coordinated agreements with multiple offshore software service providers. As the InformationWeek survey revealed, more than 90% of the big offshore clients use multiple vendors. While these data do not prove that firms have established, coordinated or interdependent relationships with offshore vendors, based on the many examples described in Table 1, it is argued that such arrangements are becoming widespread, and that there is value in structuring such coordinated relationships with multiple offshore service providers for large companies, rather than a series of independent contractual agreements with distinct suppliers [26, 27, 28].

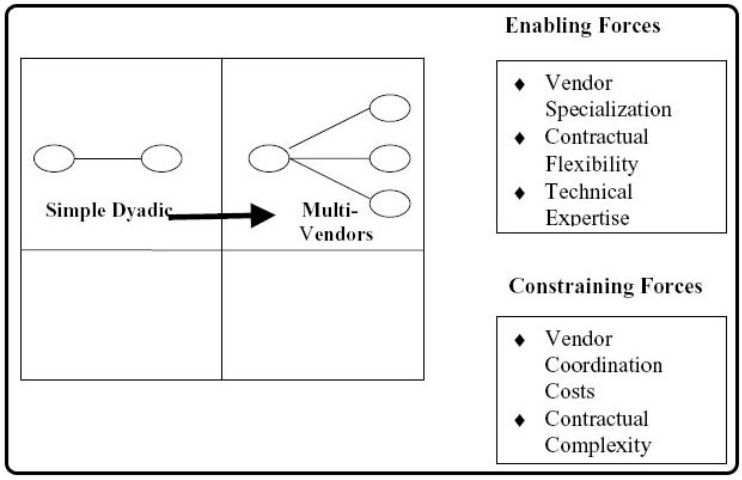

Figure 6. Comparison of multi-vendor relationships to dyadic offshore development relationships.

Figure 6 identifies the important enabling and constraining forces that must be considered when moving from dyadic to multi-vendor relationships. Three enabling forces vendor specialization, contractual flexibility and technological flexibility are the drivers that may trigger a client firm to choose multi-vendor offshore relationships.

2.7.1 Vendor Specialization

One reason that the multi-vendor approach has become more popular is that offshore IT vendors form temporary or long term strategic alliances with their competitors [26]. Such an alliance may permit vendors to focus on their core IT services while allowing their non core competencies to be managed by other vendors**.** Such vendor specialization in this regard is consistent with the classical

economists' notion of division of labor based on production economies of scale. As offshore IT vendors specialize in their core activities such as data center management or networks, they are able to reduce their variable costs by increasing their own economics of scale. A self-reinforcing cycle occurs as offshore service providers are able to increase their number of clients, enhance their skills and reputation, and drive costs further down. Such unit cost reductions also derive from offshore vendor's accumulated experience with the technology [28]. It is assumed that benefits accrued from this experience will be eventually transferred to clients in the form of reduced prices. Although the production economies of scale are created by the offshore vendors, the benefits are eventually shared with the clients in the long run.

2.7.2 Reduced Transactional Risks

A significant body of transaction cost economics literature has addressed the risks of opportunism, asset specificity or lock-in problems [29]. Intuitively, the extent to which these risks occur can be mitigated when the client deals with multiple offshore vendors. More precisely, the offshore service providers will have less incentive to behave opportunistically when other vendors in the alliances are ready and willing to substitute their role to replace a non-performing vendor. Conversely, single-vendor offshore relationships are constrained by huge switching costs, resulting in a greater risk that the IT vendor will behave opportunistically. Also, with multiple offshore vendors, clients may benefit from the monitoring activities performed by the vendors regarding their peers in the contract. Although multi-vendor alliances may appear to be based on cooperation, competition always exists behind the scenes [30].

2.7.3 Technical Expertise

Clients may be attracted by the fact that a multi-vendor approach enables them to leverage 'best-of-breed' expertise and technologies by being able to choose the best offshore service. Most offshore vendors typically have their own technical specialties in some areas of IT service while lagging in other areas. This is supported by Dataquest survey of 191 IT executives which has revealed that technical expertise is the most important criterion to consider when selecting offshore vendors while vendor's understanding of business goals was the second highest factor in vendor selection.

While some economic benefits are realized from adopting the multi-vendor approach, there are potential drawbacks. These include additional coordination costs among the client and vendors and greater contractual complexity both of which may inhibit clients from leveraging the advantages of multi-vendor alliances. In dyadic offshore relationships such coordination costs are minimized, because there are only two parties involved. Such costs will grow in some cases

coordination becomes critical to the outcomes of the relationship, yet the costs to ensure coordination may be high. When coordination degenerates whether between offshore vendor and client or among offshore vendors, the client's IT and business performance will likely suffer. Due to these complexities of multi-vendor arrangements, coordination costs favor fewer offshore vendors. This view is consistent with the ‘move to the middle’ hypothesis posed by [31] that client firms will make greater use of purchasing goods and services externally (rather than through vertical integration). In addition, however, they will generally rely on just one or two suppliers for each good in order to minimize coordination costs [31].

2.7.4 Coordinating Costs

Coordination costs include the costs associated with information search, communication and monitoring costs [32, 33]. While the first two are straightforward, monitoring costs relate to problems in principal agent relationships [34]. When the performance of offshore vendor fails to meet the client’s expectation, it is often difficult for the client to determine whether a problem is due to negligence on the part of its offshore supplier or to an unforeseeable event [13]. This responsibility problem will be exacerbated when one offshore vendor has the opportunity to point fingers at other vendors for under performance on their part. In dyadic offshore relationships such coordination costs are minimized, because there are only two parties involved. Such costs will grow, in some cases exponentially, as additional parties become involved in the relationship. When multi vendor alliances do occur, such coordination becomes critical to the outcomes of the relationship, yet the costs to ensure coordination may be high. When coordination degenerates, whether between offshore vendor and client or among vendors the client's IT and business performance suffers. Due to these complexities of multi-vendor arrangements, coordination costs favor fewer offshore vendors.

2.7.5 Contractual Complexity

Contracts usually become more complicated, as the number of parties increases. As the number of parties increases, rules and responsibilities become more complex and incomplete contracts occur [29]. Incomplete contracts refer to the fact that the agent usually takes into account less information than would be optimal for him to include in the contract. As the number of parties involved in the contract increases, legal fees incurred in writing, enforcing, and litigating such contracts will increase exponentially [35, 36]. In summary, there are a total of five enabling and constraining forces that client firms and IT vendors must consider when considering offshore software development through a multi-vendor alliance, compared to the traditional dyadic relationship.

2.8 Comparison of Co-Offshore Relationships to Dynamic Offshore Relationships

Moving vertically down Figure 5 from one client to multiple clients implies that clients seek offshore arrangements with firms with needs similar to their own. As the business environment becomes more uncertain and competitive, many firms seek to gain economic efficiency and share business and technology risks. In offshore software development practice, there is a new tendency that clients have begun to collaborate with each other to share risk and maximize their economic efficiency.

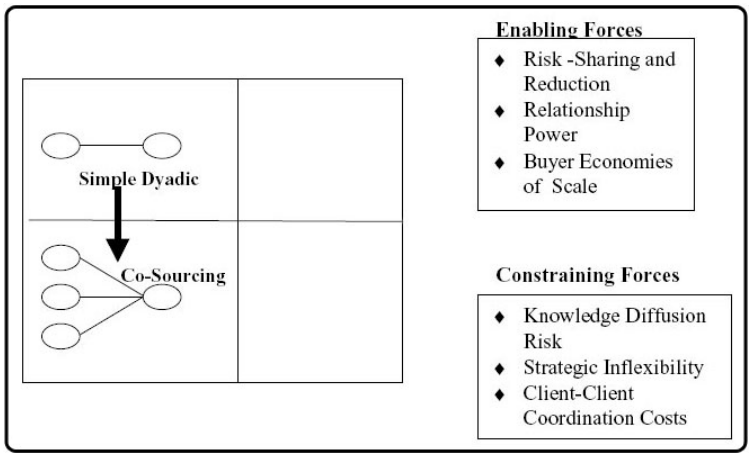

Figure 7. Comparison of co-sourcing relationships to dyadic relationships.

Such co-sourcing arrangements may occur for a variety of different reasons, and such arrangements may differ widely in terms of the specific functions off-shored, the length of the relationship (short-term, medium-term or permanent), and the balance of power among members. Figure 7 provides an analysis of the enabling and constraining forces for such co-sourcing arrangements. Three primary advantages are well understood in the strategy literature regarding the formation of joint ventures, risk-sharing and reduction, relationship power and buyer economies of scale [38]. We conjecture that these benefits can be realized by clients in teaming with other buyers whose needs are similar.

2.8.1 Risk Sharing and Reduction

One stream of offshore research has been concerned with the risk factors that arise with any type of offshore software development activity. According to [13] risk factors associated with offshore software development can be categorized into three domains, agent risk, principal risk and transaction risk. We argue while most risk associated with agents and transactions are difficult for the client to

control due to their exogenous nature, some of the client's potential for error due to their own inexperience, labeled as principal risk by [13], can be greatly reduced by engaging in co-sourcing alliances. We believe that as more client firms participate in an offshore development contract, the greater the pool of experience and the lower the chance of encountering this principal risk.

2.8.2 Relationship Power

Several critics of offshore software development argue that offshore development would lead to a loss of control of the activity or assets on the part of the clients [13, 39]. Such power decreases occur when offshore vendors assume leadership for the offshore relationship, thus limiting client's autonomy. [40] has argued that power derives from control over resource dependencies. Such resource dependencies can naturally occur in offshore development arrangements, as vendors take control of certain decisions and resources in the offshore relationship. [40] also argues that one strategy to reassert a client's power is to form coalitions of similar buyers. Such coalitions and alliances can be effective mechanisms to obtain power due to strength in numbers. Although client firms who choose offshore development option are necessarily ceding some control to vendors, multi-client alliances should enable the clients to reassert their own power and control vis-à-vis the vendors [41].

2.8.3 Buyer Economies of Scale

Due to lower input costs, large scale operations usually generate cost efficiencies. Cost savings of large volume purchasing accrue to those buyers with greater market power, due to their ability to demand volume discounts from suppliers [43]. It is likely that co-sourcing alliances will be able to generate client economies of scale by leveraging their market power. One illustration of this is that for firms presented with the option of resolving its Year 2000 problems by hiring a contractor independently versus doing so as part of an industry consortium, such firms may save considerable time and money by doing so as part of a multi-client offshore vendor alliance, due to buyer economies of scale.

Even though co-sourcing alliances allow client firms to reduce the risks stemming from market transactions, these are not without costs. The strategic alliance literature has denoted many possible dangers associated with selecting partners, coordinating and implementing contracts, and managing post-alliance relationships. Among the many reasons that encourage clients to move away from any offshore development alliance, it is analyzed that three variables that are particularly relevant to the multi-clients offshore vendor strategy: knowledge diffusion risk, strategic inflexibility, and client coordination costs.

2.8.4 Knowledge Diffusion Risk

Many researchers have warned that while interacting with offshore vendors, the clients could lose their competitive advantages as a result of the transfer of their key business or strategic knowledge to their vendor service [13, 43]. This knowledge transfer risk also exists when buyers maintain an alliance relationship with others. The interdependent nature of the alliance relationship forces firms to share both their physical and human resources, which consequently creates the environment where maintaining a secrecy is almost impossible to achieve [44]. Obviously, as the size of the alliance increases the potential for leaks and the risk of knowledge diffusion will proportionally increase.

2.8.5 Strategic Inflexibility

Despite the fact that many co-sourcing alliances are project based or short term, participating clients strategic flexibility may be constrained in more long term or strategic alliances [20]. Consider, for example, a long term industry alliance to develop and maintain industry infrastructure and standards. If a single firm is already committed to participate in such an ongoing alliance, this might inhibit it from taking advantage of other, newer alliance opportunities. This is particularly problematic when the nature of the alliance or consortium is to share common IT infrastructure. Constraints arise for two reasons: first, the remaining partners will likely object to the one firm's attempts to secede from the alliance, and second, after committing its financial resources to ongoing initiatives, the firm will find its flexibility to pursue new opportunities constrained.

2.8.6 Client Coordination Costs

Coordination is a necessary ingredient for any alliance success, though not a sufficient condition. Any conflict or friction that occurs in the alliance, due to a lack of coordination will not generate any synergies, but rather may result in chaos. In principle, these coordination costs increase as the number of parties to be coordinated grows. It is identified that coordination costs are comprised of search, communication, and monitoring costs [32]. Within the context of co-sourcing relationships, such costs will be exacerbated due to the greater overhead of dealing with additional client partners (as contrasted with the prior discussion of increased vendor coordination costs). Client firms must beware of the additional coordination burden for identifying suitable client partners, negotiating contracts that are suitable to all parties, as well as monitoring and communicating among partners on an ongoing basis.

2.9 Combining Multi-vendor and Co-offshore Approaches

The enabling and constraining forces that occur when moving from simple dyadic relationships to multi-vendor or co-sourcing arrangements have been summarized in figures 6 and 7. The same benefits and risks occur in concert when the option of complex offshore relationships are considered, here defined as combining multiple clients and multiple vendor firms into a single contract or alliance. Due to the complexity of the many benefits and risks that may occur, the outcomes of such complex relationships are difficult to predict, and are likely to be path dependent and influenced by the specific context in which they are created. The few examples of complex outsourcing relationships that exist are very recent ones, such as the alliance among seven insurance firms, Andersen Consulting and GE Capital Technology Management Services [24]. As described earlier, each offshore vendor serves a separate role and provides unique expertise to the client (insurance) firms. In terms of the actual benefits of this complex alliance, there is not yet a suitable track record to identify its outcome. It is evident that such complex multi-vendor, multi-client offshore relationships will become more common in the future. The business climate today increasingly favors business mergers, resulting in the newly merged firm continuing to work not only with their prior offshore vendors, but additionally, in the need to hire new offshore developers specifically to manage the IT integration and consolidation issues [45].

Given the combination of enabling forces that may offer superior returns from such relationships, it is alleged that more such contracts will be announced in the future. There may be many such deals in the negotiation process already, although given the number of parties involved and the potential risks to each, clearly the process for negotiating a contract suitable to all will be long. Furthermore, there are likely to be many more such offshore development arrangements in place than it is being currently anticipated. This is due to the fact that, in many cases, the press release announcing an offshore development agreement may mention only the largest offshore vendor. In doing so, such press releases may slight the role of smaller or secondary offshore vendors who are instead treated as sub-contractors to the primary offshore vendor. This tendency to overlook the smaller offshore vendors in a multiple offshore vendor relationship may occur, even when the terms of the offshore contract specify a direct relationship between the smaller offshore vendors and the clients (rather than just a contractual relationship between the small offshore vendors and the large offshore vendor).

2.10 Hidden Costs of Offshore Software Development

Generally there are a various factors for the client to consider before deciding for offshore development. How much will it cost? How long will it take? What technical skills are required? What are the economic risks? But even then one of the most important considerations is the human cost of an offshore development decision. In the best case scenario, where there is decent communication from management and workers keep their jobs or smoothly move on to new ones, the attendant changes can still cause fear, uncertainty and doubt. In the worst case, an offshore software development decision can have devastating effects, triggering deep depression and even violence among affected employees.

It is very important to consider the impact of offshore development decision on the employees in an organization which has onshore and offshore offices. The way you treat people has a way of coming back to you. To treat people with consideration at least, even if you can't muster up actual compassion because you are so left brained, it's the kind of thing that will get you respected as a leader. The less you consider people, the more you will diminish your own success and career. Another important factor is rumors. Rumors are really destructive. They metastasize through the fabric of the company. If a company is reassuring its employees one week and making job cuts the next, that's even more shocking for people because they can not believe what they are being told. Uncertainty breeds fear, fear breeds panic, and panic breeds paralysis. Employees who do not panic start polishing their résumés in a discreet manner.

It is also very important for employees to understand the rationale or the business cause for offshore development decision. It is only important after they have overcome their fear of falling through the cracks. On the hierarchy of human needs, safety and security are near the top of the list. Only after those needs are met can the mind open up to other things.

Dealing with a potential crisis as a manager is an opportunity to really test the offshore development manager’s leadership skills. If you want to command respect, you need to do four things: Have the wisdom to know the right thing to do in any circumstance, the integrity to do the right thing, the character to stand up to people who do not do the right thing and the courage to stop people who would not do the right thing. If you can do that, you'll command respect and people will beat a path to your door.

2.11 Limitations in Offshore Software Development

These days, there is certainly no shortage of debate on the relative merits or evils of offshore development. One thing is for sure that offshore development will continue to increase over the next several years. Close to 500,000 American IT jobs have already been lost since 2001, many of them to offshore outsourcing. An unspoken corporate lemming behavior will continue to fuel this growth for years to come. When industry leaders such as GE, DuPont, Citibank, GM or Procter & Gamble do something, others take notice and many will follow.

The employees in the half of the IT organization that remains in-house are mostly embedded in the business units, intimately linked to their respective company's business objectives. IT can now focus its energy on breakthrough use of technology to drive business innovation and value creation. Examples include creating real-time business intelligence systems or managing interactive marketing initiatives.

In sum, offshore software development should not be a binary, all or nothing game. Determine if there are pieces of your IT shop that could be delivered by a partner who offers greater efficiency or expertise. If so, don't ignore the opportunity out of professional pride. Money saved in your IT back office can be reinvested in your strategic front office to drive business value or simply give back toward the company's margins if that's what's needed.

The decision for offshore software development, if done wrong, is likely to produce problems. How do you grow and develop your talent base, providing broad and essential hands-on experience, when you're moving many of these roles outside? I believe this is going to be the hardest challenge for corporations embarking on an offshore development journey.

To ensure the long term development of young talent, first step is to determine the most important IT skills for your organization and retain enough of this work in-house to offer sufficient development opportunities. For example, if your company moves its programming offshore, don't move all of the work offshore. At a minimum, keep early stage prototype and pilot development in-house. This work tends to be very dynamic and needs to be close to the business, so it's not generally very efficient to offshore it anyway. More important, it provides the projects in which your young talent can get hands on learning that will serve them later in their careers as they are managing large development projects with offshore development partners.

Chapter 3

CURRENT TRENDS & PRACTICES IN OFFSHORE DEVELOPMENT

According to the latest studies, the trends and practices regarding offshore development have changed in the current IT sector of United States. Now US companies are looking for more help from foreign programmers. The primary reason for this shift towards offshore development is the shortage of IT talent and the U.S. government's freeze on issuing H-1B visas to foreign programmers has made the market for offshore programming more attractive to businesses.

Even companies that are not captivated with the idea of offshore programming are now looking at it. The primary reason behind that is using offshore programmer costs less than hiring staffers or bringing in people with visas to work in the United States. Offshore programming is most commonly used by software development companies, which tend to do a better job of managing offsite projects than corporate IT shops do. However, IT consulting and services firms are becoming frequent customers of offshore programming services as well. While international companies, particularly from US, are seeking offshore help, foreign programming companies face local challenges, making them anxious to gain U.S. clients. Economic conditions in developing countries are prompting some companies to ramp up efforts to sign international customers.

The IT talent shortage in the United States and Europe is driving more companies to use overseas developers. Until recently, outsourcing software development to offshore suppliers was seen as a cost-cutting approach used by a few large sized IT companies. Not anymore, as now offshore outsourcing is nearing critical mass. Fast-growing Internet startups, midsize businesses, and dozens of major companies are using offshore suppliers not for maintenance, but to develop sophisticated new applications quickly.

The biggest reason is the shortage of IT talent in developed countries. Companies say it's almost impossible to find enough good developers and even the not so good ones cost a fortune. In contrast, developing countries like India,

China, Pakistan and Eastern Europe have access to thousands of programmers. The availability of people trained in new technologies is one reason offshore services firms are being contracted to develop sophisticated new systems, in sharp contrast to the legacy systems maintenance associated with offshore programming in the past.

Among America's biggest companies, those using offshore programming include American Express, Aetna U.S. Healthcare, Compaq, General Motors, Home Depot, IBM, Microsoft, Motorola, Shell, Sprint, and 3M. General Electric uses four major Indian partners with dedicated facilities that employ 3,200 people who develop and maintain GE's systems, GE accounted for 8% of India's $4 billion software export business. Many midsize companies and startups are also turning to offshore outsourcing, helped by improved international communications links and spurred by the need to get software developed quickly. It seems that in the near future, the smaller and midsize companies will profit the most by offshore development, as their expansion is often limited by an inability to find technical personnel.

To avoid management glitches and to make it easier to win business with international companies, offshore firms are also establishing a stronger international presence. Establishing international offices may also reassure prospective customers who are worried about disputes with offshore services firms. Few would savor a lengthy legal battle waged in a developing country, but if offshore partners have a significant international presence, particularly in their own country or region, there is the prospect of resorting to their own legal system. The amount of coordination involved in offshore development leads to suggest that small offshore development projects should be avoided. It can take time to lay a solid foundation between partners, depending upon cultural differences, project complexities and technologies used. Thus longer projects or continuing maintenance contracts make better candidates for offshore development. But once the lines get established, it is not a resource that one would ever want to get rid of. One can ramp it up at will, hire a core team that is dedicated only to one’s needs, and reduce costs considerably.

With the U.S. Department of Labor predicting that 1.7 million IT jobs will be created this year and that up to half of them may go unfilled. The continued growth in offshore development seems inevitable. No one can grow as fast as they want to due to the chronic shortage of programmers. It is all about supply and demand. The supply is abundant overseas and the demand in international market will continue to grow.

Developing countries like Russia, the rest of Eastern Europe, Latin America, Jordan, China and Pakistan up to some level are gearing up to develop the software that is required by the international market. And many international companies are also discovering that, as long as projects are carefully managed, entrusting foreign suppliers with systems development can be highly rewarding.

3.1 Current Business Context of Offshore Development

Several Fortune 500 organizations worldwide are focusing on their core businesses and are exploring the possibilities of outsourcing both the development and the maintenance activities to software companies. For maximizing the returns on the dollars spent, organizations are also looking for software companies that have offshore capabilities. Considering that maintenance accounts for about 40% to 90% of the software life cycle costs, it is reasonable to expect that the market for offshore maintenance services is at least $5 billion [50]. This is amply reflected in the growth in software exports from India. The exports have grown from $485 million in 1995 to about $4.0 billion in the year 2000. The number of data communication circuits has gone up from 10 in 1992 to 1200 in the year 2000. In the year 2000, 185 of the Fortune 500 companies used Indian companies for their software needs as compared to 10 in 1990 [51]. Even after the Y2K related work had come to a conclusion, the Indian software industry registered a 52% revenue growth in first quarter of 2001 in comparison to the same period in first quarter of 2000 [52].

3.2 Trends in Offshore Development

The number of players in the offshore development market is on a dramatic rise. The number of sales offices of Indian software companies at overseas locations has gone up from 167 in 1995 to 582 in the year 2000 [51]. The work that is outsourced to offshore companies continues to be in the latter phases of the software development life cycle, namely, coding, testing and documentation. Most of the software maintenance work that is outsourced is in the area of maintenance of custom developed systems as opposed to product/package maintenance [52].

While there is an increased spending in the offshore software development area, the rates for onsite and offshore work are decreasing by 8 and 25% respectively. The possibility of more cost effective services from countries such as China coupled with the recent slow down experienced by the IT sector globally is bringing rate pressure on the offshore vendors [52].

Both the infrastructure and the salary costs of providing the software services are rising continuously. The software professionals salaries in India have gone up by an average of 18% every year during 1996-2000 [51].

The trends listed above are forcing the vendor organizations to scope maintenance engagements at finer levels of detail and focus on continuous process improvements to provide cost effective delivery.

After a detailed study of industrial reports, it is concluded that offshore software maintenance will be a growing business area of future. Due to a growing demand for better service levels and increased pressures on rates, there is a need to arrive at better processes to ensure cost effective delivery. Empirical studies have been conducted to analyze the maintenance mix and effort distribution on 46 software maintenance projects that support various lines of business on the IBM mainframe platform. Taking the IEEE software maintenance process as the standard, the effort and duration for various corrective maintenance tasks is measured along with the efforts spent on various activities.

Analysis of the effort distribution shows that the processes for each type of maintenance are different and there is a need to fine tune them especially in the context of offshore software development. While problem analysis and testing form a significant part of the corrective maintenance effort, teams spend efforts on other activities such as database reorganization and configuration management that are not defined by the IEEE maintenance process. Good knowledge management tools that capture information about various software components and facilitate enquiry could result in reduction of the efforts spent on analysis. Similarly, testing tools could help the teams in reducing the effort spent on conducting the unit/system testing. it is also found that some maintenance requests do not result in any change of code but clarifications and training to the users. Finally, effective communication between the customer and the offshore team and also within the offshore development team could significantly improve.

3.2.1 Job Opportunities in Developed Countries

Forrester Research estimates that the demand for offshore outsourcing will account for 28% of IT budgets in Europe and the U.S. within two years. Further, the number of offshore IT workers worldwide (software developers working overseas on projects for Western firms) will go from 360,000 today to more than 1 million by 2005.

3.2.2 Dedicated Software Development Centers in Developing Countries

While most companies tend to test the offshore waters with a small project or two, the big names tend to cement these relationships by setting up huge dedicated development centers in their countries of choice. Microsoft and GE, for example, built campuses in India several years back. Over the past couple of

years, though, Intel, Boeing and Motorola have preferred Russia as the best place for dedicated centers. Intel has 400 workers at one Russian center working on wireless LAN and modem projects. It plans to ramp this up to more than 1,000 staff over the next couple of years. Dell, too, just established a dedicated software engineering center in Moscow. Unlike Intel's, this one is managed and staffed by Russian offshore vendor Luxoft. It is a scalable upon request team of software developers, with every member being selected by Dell based on relevant experience, domain knowledge and educational background. Dell views this center as a way to focus internal IT resources on specific core areas while scaling up the pace of IT deliverables, and at the same time reduce costs.

Dell perceives that, having delegated some projects to the Moscow Center, they intend to free up the time and energy of their IT departments to enable them to focus on value-added technology tasks, while keeping the scale of IT deliverables at the current and even higher pace. Such centers tend to evolve once companies gain confidence in the ability of their offshore partner. Once you demonstrate first class ROI and rapid time to market with a Fortune 50 company during your early projects, they tend to want to consolidate the relationship by utilizing your skills and resources in the establishment of a dedicated center.

3.2.3 Acceptance of Western Intellectual Property Standards

Some companies are understandably hesitant to develop software in countries where software piracy is rife and where IP legislation is in its infancy. Russia today is like the U.S. in the early '80s in terms of intellectual property rules, they have a lot of catching up to do but they are working hard to do so rapidly.

But with leading global corporations now heavily involved in Russia and India, the legislative picture is changing. Intel believes that while it is essential to take effective IP protection actions in these countries, it has found governments receptive to changes that will encourage greater business cooperation. As a result, it is felt that great strides have already been made in Russia and other countries.

3.2.4 Impact on Value Chain

Not so long ago offshore software development dealt with mainframe maintenance, Y2K fixes and general IT grunt work. Originally, the offshore industry inherited labor intensive body shop type IT tasks such as printer drivers and Y2K. These days, the picture has changed. Java, XML, Oracle and higher end work has now become the order of the day, at least in those countries where the resource base possesses the requisite skills. Offshore resources in places like Russia are accomplished in high-end and complex algorithm intensive projects.

3.2.5 Stratification of Offshore Countries on the Basis of Cost and Skill Set

India and Ireland were once the rising stars of offshore outsourcing. Both offered very low rates and an available resource pool. More recently, though, these advantages have diminished, largely as a result of their rise in popularity. Ireland, for example, can no longer compete on price with most countries. And India now finds itself sub-contracting work to China and Malaysia in an effort to stay competitive. To survive, these countries must move up the value chain while others take their place as the place to go to find an abundance of highly skilled programmers at low rates. China and Russia are the two to replace Ireland and India as the darlings of the offshore world.

It is anticipated that within 10 years, Russia will be well known as the leading source of top-notch offshore development talent. Now U.S. companies would not approach the offshore market as a brief fling for the sake of short term cost advantage. Greatest benefits can only be realized by establishing long term meaningful relationships with offshore software developer.

3.3 Offshore Software Development Project Execution Models

While trying to arrive at the best way of working with an offshore team, different models have emerged over the years. A few of them are represented below:

3.3.1 Pure Offshore Model

According to this model, the entire project is carried out offshore. The vendor company will not have any onsite presence. The customer interacts directly with the offshore team.

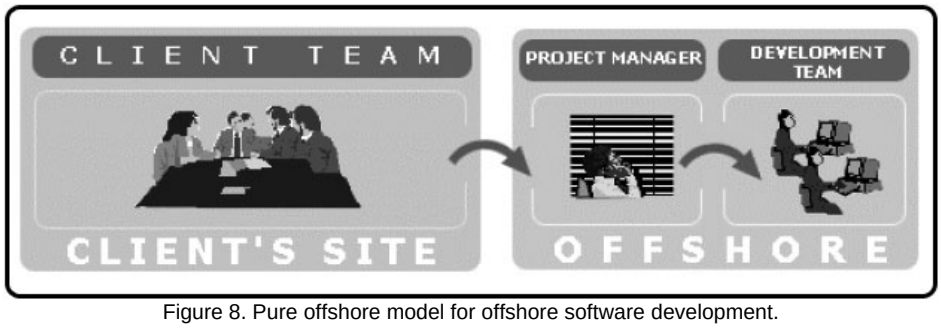

Figure 8. Pure offshore model for offshore software development.

3.3.2 On-Site Offshore Model

Under this model, depending upon the specific set of services involved and scale of the project, the vendor firm will put in place a combination of onsite and offshore technical resources that will become a virtual extension of the customer's team. On an average, 70% of the total effort is done offshore and 30% at the customer's site. Typically, an onsite coordinator or a small team from the vendor firm will be located at the customer's site to synchronize between the offshore team and the customer.

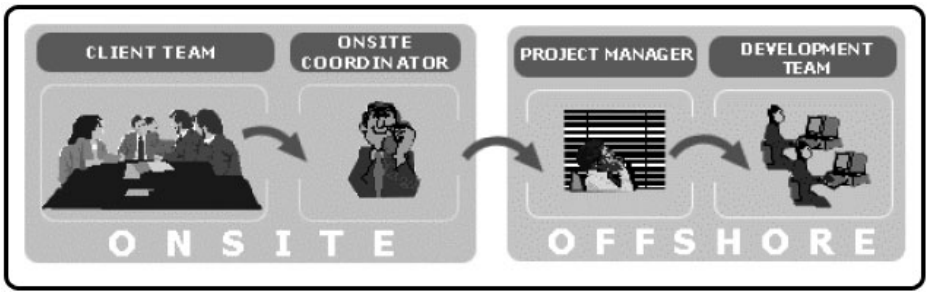

Figure 9. Onsite offshore model for offshore software development.

3.3.3 Off-Site Offshore Model

In this model, the vendor company will have its own office close to the customer's site. A team of engineers from this office will coordinate between the customer and the offshore team. The onsite-offshore model has by far been the most successful one among the various models that have emerged. The simple reason being to have satisfaction of coordinating and discussing requirements and deliverables with an onsite team, while at the same time enjoying the offshore cost advantage, unlike pure offshore model.

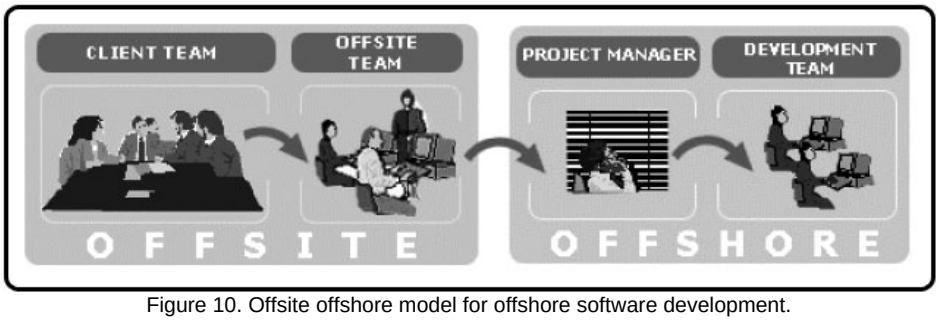

Figure 10. Offsite offshore model for offshore software development.

3.4 Offshore Software Development Business Model

The first method of managing the risks associated with offshore development is inherent to the selected business model. Companies seeking to employ offshore development resources generally operate in one of the following business models:

3.4.1 Direct Investment

According to this business model enterprises create up wholly owned facilities or enter into direct partnership with offshore consulting firms. Benefits associated with this approach are that risks related with intellectual property rights and copyright ownership are mitigated up to certain extent. While in this case company is exposed to greater geopolitical risk as well as complexity of legal, tax and labor issues also broadens

3.4.2 Strategic Outsourcing

Under this business model, enterprises enter into contracts with offshore firms for software development. The major advantage by following this business model is its intrinsic lower risk and cost option. However certain risks can be amplified due to loss of control and visibility, hidden costs of project management and communication, increased exposure to data loss and network security. Moreover risks related with intellectual property and copyright can also enlarge.

3.5 Offshore Software Development Methodology

The offshore development process usually begins at the customer's site. A team of analysts led by a Project Manager carry out the initial requirements definition and analysis in consultation with the customer. The design, development, and testing phases are carried out at the offshore development center with a larger team. The acceptance testing, implementation, installation, and user training are done at the customer’s site. On an average 70% of the total effort is done offshore and 30% onsite.

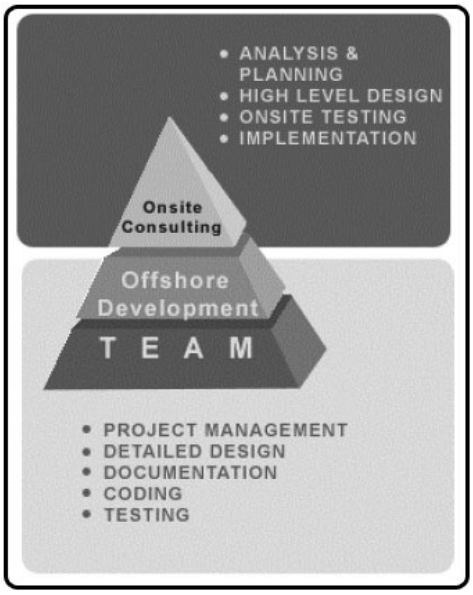

Figure 11. Methodology for offshore software development.

An outline of steps involved in the onsite/offshore model is:

a. A Project Manager from the development team and a Project Coordinator from the customer's end are nominated to oversee the entire project.

b. To start with, the Project Manager and a team of engineers from the vendor firm visit the customer's office to establish rapport with the Project Coordinator, discuss, understand and document requirements, establish communication protocol and finalize reporting format and frequency. It is absolutely necessary that the Project Manager and his team gain an in-depth understanding of the requirements and communicate the customer's vision of the application back to the offshore center.

c. Once the initial requirements have been understood, the customer's design approach, development and testing standards and norms for acceptance, if any, are studied. A detailed project plan that entails the resources for the project, duration of the project, milestones and deliverables to be achieved is prepared.

d. While the Project Manager and the majority of his team return with the above information and prepares a project prototype, architecture and detail design for the customer's approval, one or more members of the team stays behind with the customer to coordinate the onsite/offshore activities.

e. Once the customer has signed off on the requirements and prototype, the core development team gets going on the work. Constant interactions between the project manager and the onsite coordinator enable quick clarification of any doubts.

f. Upon completion of the project, the vendor team will carry out the implementation and installation of the project at the customer's site.

In certain cases, some amount of preliminary design is completed onsite during the Project Manager's visit. Subsequently, the development and testing take place. In many cases, the various steps mentioned above overlap, compressing the total time. The project as envisaged could include onsite installation and implementation support followed by offshore maintenance. Onsite visits are required initially for bringing the project offsite and at the end for delivering the software. The actual sequence of steps could vary depending on the specifications of a given project.

3.5.1 Cost Facet of Offshore Development Methodology

The cost advantage linked to offshore outsourcing increases with the percentage of development effort outsourced and the percentage of work performed offshore. They are maximized when the entire development is outsourced and all the work is performed offshore.

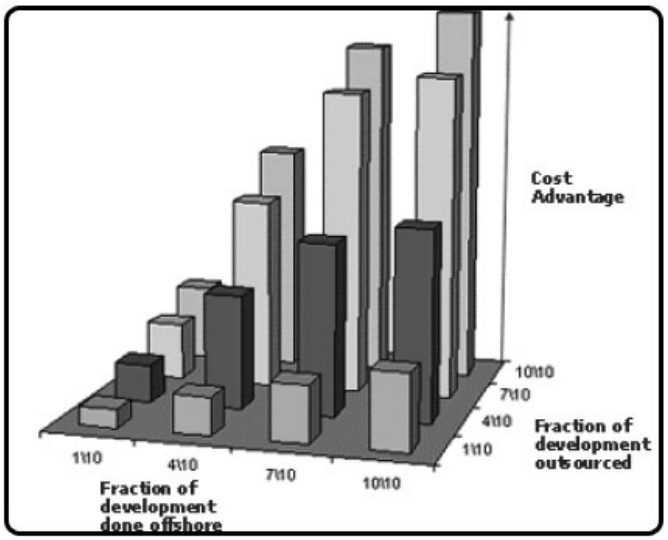

Figure 12. Cost advantages associated with offshore software development methodology.

Obviously, this may not be a savvy business decision because over time the outsource organization controls the product and you are reduced to being a marketing arm of an offshore organization. If you have good control over the intellectual property rights and if you have a reliable partner in whom you have an ownership stake, you can choose to do it this way. Else it would be better to have a certain amount of control from your side with a talented Chief Technology Officer and a product team.

Let's analyze a couple of scenarios where projects of varying sizes are carried out at an offshore center and evaluate the resulting cost savings.

3.5.1.1 Scenario I

This scenario is applicable to a trial project that you might want to test out with your potential offshore partner. Let's assume just a 5 man-month project (800 hours) and work out the costs. Typically a project of this size does not warrant deploying the onsite/offshore model.

Team	Offshore Development				Internal Development		
	Primary Location	Hours	Rate Per Hour	Total	Hours	Rate Per Hour	Total
Project Manager	Offshore	160	$40.00	$6,400.00	160	$80.00	$12,800.00
Project Coordinator	Offsite	80	$80.00	$6,400.00	-	-	-
Software Engineer	Offshore	480	$20.00	$9,600.00	480	$50.00	$24,000.00
QA Engineer	Offshore	160	$20.00	$3,200.00	160	$50.00	$8,000.00
TOTAL		**880**		**$25,600.00**	**800**		**$44,800.00**

Savings:
$19,200.00 or 42.86%

Figure 13. Scenario I of offshore development model.

In other words, there would not be a need for the vendor firm to have a constant onsite presence and most of the coordination required can be done through phone and emails. We will assume that the vendor firm will coordinate with the customer from an offsite location close to the customer. This will cut down the travel costs of an offshore member having to travel to the customer's site. Further we will assume that the overhead of external vendor communication will increase the overall project hours by 10% as compared to in-house development.

3.5.1.2 Scenario II

Larger projects could potentially mean more savings. Let's take a look at a 120 man-month project (19,200 hours) executed over 8 months with a 15 people team. In this case, we will assume that the offshore team will travel to the customer's site at certain stages of the project. Further, we will also assume that the vendor firm has a constant onsite presence at the customer's site by having one or more of its engineers there during the entire course of the project. Due to this fact, the customer can work closely with the vendor just as they would with an internal development team and the additional communication overhead considered for the trial project will not arise in this situation.

Team	Offshore Development				Internal Development		
	Primary Location	Hours	Rate Per Hour	Total	Hours	Rate Per Hour	Total
Project Manager	Offshore	1280	$40.00	$51,200.00	1280	$80.00	$102,400.00
Project Coordinator	Onsite	1280	$80.00	$102,400.00	-	-	-
Module Leaders / Architect	Offshore	3840	$25.00	$96,000.00	5120	$65.00	$332,800.00
Software Engineers	Offshore	8960	$20.00	$179,200.00	8960	$50.00	$448,000.00
QA Engineer	Onsite	1280	$50.00	$64,000.00	3840	$50.00	$192,000.00
QA Engineer	Offshore	2560	$20.00	$51,200.00	-	-	-
Travel Expenses				$24,000.00			-
TOTAL		19200		$568,000.00	19200		$1,075,200

Savings:
$507,200.00 or 47.17%

Figure 14. Scenario II of offshore software development.

3.6 Assessing Risks in Offshore Software Development

Offshore development decisions, and contractual arrangements of the type required by an software offshore development deal, entail risks. This is not to say that offshore software development is bad in itself. It only means that, as in other risky business ventures such as new product development, capital investments, and IS projects, risk assessment and risk management are important contributors to the success of an offshore development venture [53].

1. Assess the loss due to undesirable outcomes :
- Identify the potential undesirable outcomes for a given project ;
- Evaluate the magnitude of the potential loss due to each negative outcome;

2. Assess the risk probability :
- Identify the risk factors that might lead to undesirable outcomes;
- Identify the links between risk factors and undesirable outcomes;
- Assess the extent to which each risk factor is present in the project.

Figure 15. Risk assessment procedure.

In any situation, several undesirable outcomes may occur. Among the examples listed above, undesirable consequences would be, shortfalls in systems performance, disruption of service to customers, hidden costs, and loss of innovative capacity [54]. The loss due to a given undesirable outcome can be approximated either via quantitative analysis (for instance, by evaluating the amount of sales lost due to disruption of service to customers) or via qualitative assessment of the organizational impact of each negative outcome (for instance, by using Likert scales to assess the importance of the impact of the undesirable outcome) [55, 56].

In certain circumstances, the probability of occurrence of an undesirable outcome can be estimated on the basis of past performance characteristics of the object under study [57], or subjective probabilities can be assessed [58]. However, in several areas, probabilities are often difficult, if not impossible to assess on the basis of past performance [55]. Consequently, several risk assessment methods adopt the approach of approximating the probability of undesirable outcomes by identifying and assessing factors that influence their occurrence [55, 59, 60]. In a software development context, for instance, [55] have identified such factors, which belong to five broad categories, technological newness, application size, software development team's lack of expertise, application complexity and organizational environment. The degree to which each factor is present in a software project will contribute to increase the probability of occurrence of an undesirable outcome (here, project failure).

On the basis of this definition, risk assessment consists of the steps listed in Figure 15. Since all the risk factors do not give rise to all the undesirable outcomes, risk assessment should also link risk factors to undesirable outcomes. For instance, in the case of a software development project, the lack of project team knowledge about the activity to be supported by the application under development is a risk factor which is linked to the negative outcome of having a system that does not adequately respond to user information needs [61]. Yet, this undesirable outcome is less likely to be closely linked to the risk factor defined as shortfalls in externally furnished components [58].

Some of the activities of Figure 15 are generic to a given type of project or decision, while others have to do with a particular project. Identifying the potential undesirable outcomes, identifying the risk factors, and identifying the links between risk factors and undesirable outcomes are generic activities. The literature on IS project management, for instance, provides lists of undesirable outcomes and risk factors [55]. What is specific to a particular project or decision is the evaluation of the magnitude of the potential loss due to each negative outcome, and the assessment of the importance of each risk factor.

3.6.1 Undesirable Outcomes of Offshore Development

In their discussions of IT outsourcing, several authors, both from academia and from practice, have identified undesirable consequences that might result from such a venture. Three sources were particularly useful in this exercise since they devote much attention to this dimension of offshore development arrangements [62, 63, 64]. Since offshore software development is a typical example of a make or buy decision, industrial organization literature was also used as a source for identifying negative consequences of offshore development. Table 2 synthesizes this literature review. The first group of undesirable consequences pertains to hidden costs, which are sometimes said to be the biggest IT outsourcing problem [65]. Transition costs include setup costs, redeployment costs, relocation costs, parallel running costs, and so on. Management costs refer to the human resources that have to be put into managing an outsourcing contract. According to [63], companies often underestimate these two types of costs, which can increase quite rapidly. Cross [66], for instance, reports the experience of British Petroleum who, after having off-shored its IT operations to several vendors, discovered that such contracts required far more management resources than they were worth [66]. In a discussion about the cost-benefit aspects of the software acquisition decision, [67] identify another type of costs that could be added to the transition and management costs mentioned by Earl. These are contracting costs that include the costs related to searching and evaluating the appropriate offshore vendor, benchmarking the services offered, specifying the legal terms of contracts, negotiating contracts, and resolving disputes. [64, 65] identify another type of hidden costs, that is, those costs that the client assumed were included in the contract, but which, in fact, were not. They give the example of maintenance on personal computers, sales tax on equipment purchases, rewiring for office moves, etc, which can add up to several hundred of thousands, even millions, of dollars.

Hidden costs	Hidden transition costs and management costs Hidden service costs
Contractual difficulties	Costly contractual amendments Disputes and litigation Difficulties in renegotiating contracts Lock-in
Service Debasement	Diminished quality of service Increased costs of services
Loss of organizational competencies	Loss of IT expertise Loss of innovative capacity Loss of control of the activity Loss of competitive advantage

Table 2. Undesirable consequences of offshore software development.

Contractual difficulties constitute another category of negative outcomes of offshore software development. Contractual amendments are often necessary, either because the client's needs are changing, or because most contracts are indeed incomplete [68, 69]. As a result, several firms have seen their outsourcers charge them high fees for such new services or changes in the services rendered [63, 64]. Sometimes, requests for changes give rise to disputes, and even litigation. Disputes also occur over the meaning of contractual terms: services to be rendered, service level, personnel expertise, etc. At the time of contract renewal, other difficulties may arise. An unsatisfied client may wish to repatriate the service. Yet, they may encounter several difficulties in attempting to do so. Often, the required assets will have been transferred to the offshore developer, along with the personnel who possessed the expertise to conduct the outsourced activity. Not only can repatriation be very costly [62] in some occasions, it will be impossible [70]. The client might then consider the alternative of transferring the service to another offshore developer. Yet, if the number of suppliers is small, this might be an impossible alternative [69, 71, 72].

Service quality and service costs are two major issues in offshore software development. The literature provides numerous examples of degrading service levels resulting from offshore development including poor response time, poor turnaround time, late updates of software, applications that do not meet the requirements, and so on. Often, parallel to service degradation, service costs rise. For instance, one of the firms indicated that their outsourcing costs were almost three time the costs of internal services.

The area of organizational competencies appears to be quite vulnerable in the offshore development context. Offshore development deals almost always include IT personnel. The very fact that no, or little, IT expertise remains in the firm is seen as dangerous, since the firm will have lost its ability to use IT efficiently and effectively, and will remain dependent on an external supplier. The ability to align IT with the firm's strategy might also be hampered, thus affecting the firm's ability to maintain competitive advantage, and to use IT in an innovative fashion [63, 73].

3.6.2 Risk Factors

According to the risk definition provided earlier, undesirable outcomes are due to risk factors. Table 3 presents a list of such factors identified from the literature. In the context of offshore software development, transactions costs theory and agency theory are particularly relevant to the risk factor identification exercise. Table 3 outlines the risk factors according to the three key concepts of these two theoretical frameworks (agent, principal, and transaction). Agency theory is concerned with the coordination and motivation issues that are inherent in a relationship between a principal (the client) and an agent (the offshore vendor).

Agent	Opportunism : moral hazard, adverse selection, imperfect commitment Lack of experience and expertise with the activity to be outsourced Lack of experience and expertise in managing outsourcing contracts Number of suppliers
Principal	Lack of experience and expertise with the activity to be outsourced Lack of experience and expertise in managing outsourcing contracts
Transaction	Asset specificity Uncertainty Measurement problems Frequency Interdependence of activities Proximity of core competencies Technological discontinuity

Table 3. Risk factors in offshore software development.

A basic assumption of agency theory is that opportunism is an inherent characteristic of such a relationship. Opportunism leads the principal or the agent to seek their interest 'with guile', to deviate from the behavior prescribed by the contract whenever they benefit by doing so, cheat, shirk or lie. This is not to say that principals and agents will always adopt an opportunistic behavior. Moral codes, social norms, the risk of prosecution, and the possible detrimental effects on reputation tend to limit the extent of opportunism. Yet, these constraining factors do not prevent all opportunistic behavior [74, 75].

Opportunism is an important risk factor in an offshore development contract. There are three main manifestations of opportunism, which are moral hazard, adverse selection, and imperfect commitment. Moral hazard results from the fact that it is impossible for a principal to observe the behavior of the agent, without incurring prohibitive costs. Since the client cannot directly observe the level of effort deployed by its supplier, it cannot easily tell whether a problem is due to negligence on the part of its supplier or to an unforeseeable event. Since the supplier knows the client cannot tell, the supplier can always blame poor performance on circumstances beyond its control. Adverse selection will develop when the principal cannot observe the characteristics of the agent. The client must validate the suppliers' claims, which often is a difficult task. On the other hand, the supplier is often aware of this difficulty. Failure to deal adequately with adverse selection will make it very challenging for the client to choose the appropriate supplier. Sometimes the agent truly believes that they actually have the required characteristics to adequately perform the activity. In some circumstances, the supplier may commit an error of over-optimism in evaluating its true capacity to fulfill its contractual obligations.

An excess of confidence will then lead him into a contractual agreement he, and the client, will soon discover he cannot respect. [35] has suggested that many acquiring firms which accepted to pay huge premiums to a target were led by managers with exaggerated beliefs in their capacity to turn around the target. Finally, imperfect commitment is the imperfect capacity of both the client and the supplier to commit themselves. For instance, clients and outsourcers may be tempted to renege on their promises and commitments. No contract is immune

from such behavior. A supplier will refuse to deliver the services or adapt applications because, for instance, it claims that such adaptations had not been foreseen, or because the language of the offshore development contract is not clear. Other characteristics of the agent constitute sources of risk.

The lack of experience and expertise of the agent with the outsourced activity is one of them [63]. It may happen that a supplier, eager to obtain a contract, exaggerates the expertise it possesses with certain activities. Lack of expertise may also occur over time. Since several firms decide to outsource their legacy systems, vendors hire and retain IT personnel who are familiar with older technology. When the client needs support with new technology, the supplier might not have the required skills available. Another risk factor is the lack of experience or expertise of the agent with the management of offshore development relationships, which could lead to disputes and to escalating costs. Finally, the extent of competition among agents, which is often related to the number of available vendors, is also a risk factor. A small number of vendors may bring about the locking problem, since it will be difficult for the client to find alternative sources of services [76]. The principal itself is a source of risk factors. In particular, [43] identify the lack of experience or expertise of the principal with the activity to be outsourced as a major risk factor. These authors claim that while firms might be tempted to outsource those activities that they do not do well, or that they do not understand well, going ahead with an offshore development decision would lead to negative outcomes. The lack of expertise with the off-shored activity may also have a negative impact on the ability of the principal to adequately manage the contract, since they will have difficulty in assessing the quality and the costs of the service rendered. As was the case with the agent, the principal's lack of experience and expertise with the management of offshore development contracts is another risk factor, since an inexperienced principal is more likely underestimate transition and management costs, for instance and be vulnerable to the agent's opportunistic behavior.

Some characteristics of the transaction, that is, of the activity to be outsourced, are important risk factors. Asset specificity refers to the degree to which an asset can be redeployed without sacrificing its productive value if the contract is to be interrupted or prematurely terminated. Because the next best use value of a specific asset is much lower, the investor would lose part of its investment if the transaction was not completed. This creates a lock-in situation where the other party (not investing) could extract an advantage from the investor by threatening to withdraw from the transaction [72]. For a market to be efficient, parties must be able to predict with enough certainty the activities to be performed in a contract and to measure the value of the elements exchanged. This is often proven false. Transactions are conducted with a certain level of uncertainty and are subject to measurement problems [77, 78]. For example it may be difficult to predict future user needs in a given project. Evaluating the adequacy of a specific system delivered is also an arduous task, since system quality is difficult to assess without extended use [67].

Frequency is another key dimension of a transaction. Organizing a transaction within the firm implies the creation of a governance structure. This generates important and irreversible costs. If a transaction is known to be unique, these costs will likely be too significant to allow for the integration of the activity within the firm. The firm will prefer to bear the cost of the risks associated with investments or uncertainty rather than invest in order to internalize a single transaction [72]. The degree of interdependence of the activities to be outsourced or technological indivisibility [63] has also been identified as a one of the transaction characteristics that constitutes a risk factor. According to [42], outsourcing interdependent activities may cause serious difficulties. [79] illustrates this type of problem with a dispute over poor response time. The supplier in charge of computer operations blamed the telecommunications firm for poor service, while the telecommunications firm blamed the principal for not having the appropriate equipment, and the principal put the blame on the outsourcer responsible for computer operations for not providing good service. In such a situation, the real source of the problem might be very difficult and costly to determine. Technological discontinuity is closely related to uncertainty, since it refers to one aspect of the volatility of the environment that cannot be anticipated [76]. By technological discontinuity, we mean technological changes and breakthroughs which may make obsolete the technology which is was part of the contract. In the case of a long term contract which specifies a certain type of technology, transferring to the new technology may incur additional, prohibitive costs.

On the other hand, if the client does not adopt the new technology, and its competitors do, then reduced competitiveness might result. Finally, proximity to core competencies is also a risk factor, the presence of which may lead to undesirable consequences. Outsourcing an activity that is close to the core competencies of the organization presents risks [80]. [81] detailed the risks of dependency that were associated with that behavior. When handing out these activities to a supplier, the organization risks that the suppliers will either supplant the client in its own domain, or move in directions different from the ones the client might have chosen. Organizations also must keep the learning associated to their core activities in-house. However, this is often not an easy task since the core is not always a stable set. This analysis is linked to the corporate coherence. Organization learning is facilitated when the organization is centered around its essential capabilities. Outsourcing an activity at the core of the organization might impede organizational learning and lower the competitiveness of the organization [82].

3.7 Resource-Based View of Offshore Development Risks

As the practice of offshore software development has grown exponentially over the past few years, one core issue has dominated both research and IS management. Which resources can or should be outsourced? This question has centered our attention on the corollary problems of how to evaluate risk and how to minimize it. Recent research has compiled lists of the risks and threats of outsourcing, and we have begun to develop crude tools for identifying practices that should help businesses minimize or avoid the risks of offshore development.

Much of what we've learned academically has been from intensive and extensive case studies. As a consequence, our understanding of outsourcing issues has grown more from a system of trial, error and report than from theory-based research. What theory or theories offer the most to our study of outsourcing? We may argue that the problem of effective outsourcing must drill down, eventually, to the economic issue of the theory of the firm and its fundamental questions: Why do firms exist? What is the cause of their scale and scope? [83, 84]. Why is not all business or commerce conducted by individual contractors on the market? To ask when and how and why a firm should outsource its information technology, we may turn to the theoretic question, when and how and why should a firm outsource, or not outsource anything? Why does a firm exist at all? Using this approach, we find that theory helps us answer not "which resources should be outsourced," but rather, "which ones should not?" Two non-exclusive theories of the firm offer valuable perspective on this problem. Transaction cost economics [85, 86] offers a view of the risks of opportunistic behavior accompanying various transactions. The Resource- based view of strategic management focuses on the value and accessibility of unique or costly-to-copy attributes of the firm.

Both theories are useful in understanding risks to the firm when it turns to the market to source its IT resources. Transaction cost economics, which derives from the argument that the firm exists to avoid excessive transaction costs, provides a model for specific conditions under which transaction costs are particularly likely to be excessive or where opportunistic behavior is a serious risk to the transaction. The primary reasons for outsourcing IT have been routinely identified as cost containment and acquisition of expertise [87]. Managers outsource when they expect the market to be more cost efficient than vertical integration and/or when they believe skills, knowledge or experience are available via the market that are not available in-house. The transaction cost approach to outsourcing applies to the cost-containment objective. It has been used and cited as potentially helpful to predictive models of outsourcing risk and success as well as the outsourcing decision [88, 89, 90]. Early wisdom for outsourcing dictated that we outsource only "commodity" IT (those resources which can be clearly defined and which are available from numerous vendors).

Those resources seemed the most likely to harvest cost benefits for the firm without risking the hazards of major dependence on a vending firm which may lead to high transaction costs.

Strategic IT resources were to be maintained internally. Yet increasingly, IT outsourcing literature discusses strategic alliances and partnering as a valid approach to effectively outsource more strategic IT resources [91, 92]. Beginning with the much-vaunted Kodak outsourcing case, partnering has been proposed to be a means of reducing the risk of opportunism while the firm acquires externally the expertise and technical resources that may offer an IT-based source of competitive advantage. Does a partnering arrangement for acquiring complex IT resources actually allow the firm to avoid transaction costs, and consequently make outsourcing strategic IT feasible? The Resource-based view of strategic management does not conflict with the ideas of transaction costs, but it raises issues beyond those of opportunism. Rather than focusing on the conditions affecting risk of opportunism in market-mediated exchanges, RBV focuses on characteristics of the strategic resources that affect their value and mobility. Thus it may be used to help us identify and evaluate risks of outsourcing beyond, or assuming away, the problems of transaction costs and opportunism.

Following sub section explores the contributions which TCE and RBV offer to the problem of which IT resources may not be acquired reliably and successfully via the market. Particularly, the contribution that RBV offers in carrying forward our thoughts about outsourcing in an opportunism-free scenario. In the following sub section we will first explore current perspectives on types of IT outsourcing. We then explore aspects of both TCE and the RBV for their respective contributions to the IT outsourcing problem. Finally, we will suggest directions for empirical research in IT outsourcing based on the theories at hand.

3.7.1 Resource-Based View

While it is certainly true that uncertainty of needs and resources may lead to imbalanced contracts and opportunistic behavior in market transactions, we must recognize that such uncertainty is also a common state in business. The resource environment, especially in information intensive industries [90], is dynamic. The IT resource environment is volatile in the extreme. Technology based opportunities occur as new technologies emerge and new applications are developed; competitors introduce new, information-based products or services which create new IT based competitive necessities into the industry; and strategies change. Hence as needs and opportunities change, the firm is hard-pressed to ensure that it controls the IT resources needed to meet new competitive challenges. While the RBV absolutely recognizes the hazards of opportunism and their relevance to a firm's sourcing choice, it extends our study of resource value and control in conditions of uncertainty. In particular, with the RBV, we explore the problems of acquiring or managing resources that offer

strategic value [83, 93, 94, 95]. The RBV rejects traditional economic assumptions that resources are homogeneous and perfectly mobile. That is, firms are assumed to be heterogeneous in terms of the resources they control or can readily acquire [96].

	TCE	*RBV*
Market / Contract Characteristics	Uncertainty Number of vendors Contract expertise Contract duration	Strategic Factor Markets
Resource Characteristics Affecting Risk	Uncertainty Complexity	Uncertainty Complexity Resource Homogeneity Resource Mobility
Risk	Transaction costs Opportunism	Asset erosion Loss of access to assets Loss of control over strategic assets

Table 4. Key factors for offshore development: Transaction Cost Economics vs. Resource Based View.

The application of this assumption to IT resources may not be immediately obvious. Indeed, the market for IT products and services has become enormous. Virtually any IT product can by acquired externally, either in standard packages or through custom development. However, valuable resources may not have the same competitive value to all competing firms, and they may not be evenly accessible [93, 96]. This fact is the key to the development of a resource-based perspective of IT outsourcing. The value of resources may vary as they occur in bundles of resources, and consequently, the value of the same resources may be heterogeneous across competing firms. Using the RBV, we focus on value, accessibility, and control of valuable resources, those resources that may afford competitive advantage to the firm. One of the key problems in securing such resources is identifying which resources have this potential. Table 4 presents a comparison of RBV and TCE views of outsourcing factors. As they change, the value of various resources, especially those that may affect the firm's ability to act, change along with them.

Consequently, where uncertainty clouds the characteristics of resources (including their value), the value of resources is heterogeneous, and resources are not reliably mobile, we find that managers must concern themselves with more than the problem of transaction costs and opportunism. In dealing with resources such as IT, which are dynamic in characteristics, in usage, and in value, additional unobservable resources are needed and used to manage them. Organizational routines, knowledge, learning, and capabilities may all be included in this set [97, 98]. The RBV of the theory of the firm suggests that a key function of internal organization is the management, the acquisition and maintenance, of these unobservable resources which enable the firm to maximize its ability to take advantage of emergent strategic opportunities under the normal but difficult condition of uncertainty [98, 99, 100].

Our general concept of strategic opportunity may be described as a basis for new sources of revenue. Information based strategic opportunities are increasingly understood to be very widespread. They may take the form of new products, new services, or new markets. They may take the form of improved operations that may move the products or services to the markets more quickly or inexpensively [101]. Capitalizing on a valuable opportunity requires a number of actions and capabilities from the firm.

First, the opportunity must be recognized. Then, the firm must be able to acquire or divert quickly the resources needed for its response. In order to divert or acquire resources and to implement them in the time needed for a strategic move, two important intangible resources are required: knowledge and control. A decision-maker must have both the knowledge to understand the opportunity and adequate control of firm resources to be able to secure them for the project before the strategic value of the opportunity lapses. The RBV helps us build the argument that where IT resources have potential strategic value to a firm, or where a firm strategy potentially may depend on IT resources knowledge, control, and a third capability, learning, are key to strategy implementation [97, 102]. We may then find that these unobservable resources have as much impact on outsourcing viability as the conditions that led to opportunism. That is, the unobservable may necessitate organization (internal sourcing) even when efforts on the part of the vendor and buyer for a fair transaction are earnest and sincere.

3.8 Resource-Based View of Offshore Development

Before contracting with any offshore developer, it is critical to evaluate that developer. An offshore software developer can be evaluated on three main basis including, company, people and technology.

3.8.1 Company

Companies are no longer simply contracting out the work, their ties with their vendors get stronger the more they outsource. Evaluation of software developer from company's perspective include company stability and investment, company size, location of offshore facility, infrastructure status, security issues, cultural issues and flexible contract.

3.8.1.1 Company Stability and Investment

In company stability and investment, this thing is checked whether vendors which are evaluated be just riding on the IT wave and might have formed the company without laying strong foundations. Many companies have not even been in business for one full year, and have dissolved completely. Hence, it becomes very crucial to gauge the stability of the offshore vendor by considering commitment, experience, customer relationship, company growth, funding position, etc.

3.8.1.2 Size of the Company

Size of the company is definitely important to make sure that the offshore vendor has enough resources and pays good attention to execute the outsourced projects in a timely manner.

3.8.1.3 Location of the Offshore Facility

The reason for choosing any specific offshore development country would depend on the socio-economic, business and political scenario prevailing in the offshore country. These scenarios differ from one offshore country to another based on the policies laid down by the Governments there.

3.8.1.4 Infrastructure

It is essential to find out if the offshore firm has adequate infrastructure apart from human capital to support projects of varying complexities. Lack of proper infrastructure like power, internet/broadband connectivity, transport facilities, etc may cause serious habitual problems in reaching milestones and quench any inherent cost advantage.

3.8.1.5 Security

Engaging an outside firm to execute development work means sharing valuable information about the project. This is risky especially in cases of a proprietary product or in case of outsourcing client's work to an outsider. Hence, client needs to ensure that vendors allow only the offshore team members to access project related materials.

3.8.1.6 Culture

Many outsourcing relationships have come to an end due to cultural mismatch. It is crucial to discuss and agree upon a common mode of work operations.

3.8.1.7 Flexible Contract

Signing a very clear and flexible agreement that ensures a comfortable feeling about client relationship with the offshore vendor is the most critical thing about an offshore outsourcing relationship. Schedules and deliverables, guarantees, payment, conflict resolution, risk cover, term, expiration, & renewal should all been discussed before the project commences.

3.8.2 People

It primarily deals with the skill sets of the people/employees involved in the offshore development of the project.

3.8.2.1 Skill Sets

The availability of a large pool of skilled human capital in offshore countries brings in a wider choice and flexibility in selection and hiring of team members while keeping the associated cost structure low. This also paves way for any quick ramp ups in team size that may be needed at any point in time.

3.8.3 Technology

Technology perspective for offshore developer evaluation includes project management procedures and software development process maturity.

3.8.3.1 Project Management

The importance of project management is very pronounced in case of offshore outsourcing. You need to ensure the existence of a clearly defined and professionally followed project management system in the offshore vendor's development unit.

3.8.3.2 Software Development Process

The software development process adopted by the offshore firm bears a lot of significance while choosing the right firm to entrust a project. A well defined process reduces the software development risk and allows the project delivery date to be rightly predicted.

Chapter 4

SURVEY METHODOLOGY

4.1 Data Collection

A survey has been conducted for this dissertation between April and June of 2005, to probe the different types of issues faced by the local software organizations which are involved in offshore software development. This survey has been conducted in two parts and through this survey, I have also tried to put some light on the current trends and practices followed in our local software industry, in relation with offshore software development. This survey also highlights the major problems and obstacles faced by organizations in effective implementations of software project management practices in the milieu of offshore software development. For this purpose, a comprehensive questionnaire was framed, for each part of the survey, to collect maximum related data from the software organizations in a structured way. In the first part of the survey, Questionnaire - A was sent through electronic mail to 26 different software organizations. The results of this part of survey are based on the responses of 17 software organizations, received through electronic mail. These 17 software organizations are medium to large size organizations, based in Islamabad and Lahore in Pakistan. In the second part of the survey, Questionnaire – B was sent through electronic mail to 26 software organizations. These 26 software organizations were same as for Questionnaire – A. the results of this part of survey are based on responses of 14 software organizations, received through electronic mail. The survey results are presented in a subsequent section and later I have presented the data analysis. The conclusion of this paper has been drawn on the basis of the survey results and data analysis.

4.2 Data Description

For this survey data has been collected from software houses located in Islamabad and Lahore. Most of the software houses are small or medium scale organizations, only two of them are large scale organizations with more than 100 employees. Data is collected through two questionnaires, Questionnaire – A and Questionnaire – B. Both questionnaires were sent to 26 organizations. For questionnaire – A, 17 responses were received while for Questionnaire – B 14 responses were received from software organization. The data collected through both questionnaires is mostly organization specific and that is why only one questionnaire is included in the survey against one software organization.

As mentioned in the questionnaire that the name of the person, projects and organization will not be disclosed in the survey results and analysis but only a consolidated picture of the data will be presented and discussed. Thus the discussions and results of this survey are not specific for any organization but they address the overall situation.

Basically there are four scales of measurement namely, nominal, ordinal, ratio and absolute scales. Only the ordinal and ratio scales are used in the questionnaire to collect the required information. For analysis purpose the ratio scale is mostly used as it provides a clear picture of the situation.

4.3 Survey Results

This section exhibits the results of the survey, based on several questions from both questionnaires. The survey results encompass the responses of senior managers including project managers along with some senior software engineers and analysts. The average experience of the respondents is 4.6 years. The questionnaires contained a lot of questions; some of them were just targeted to get an overview of the organization. In this section, results of only those questions will be presented which are related to the context of offshore software development. I shall present the results of Questionnaire – A, and after that results of Questionnaire – B will be presented.

In Questionnaire – A, the first question was regarding the organization's involvement in offshore software development. A wide majority of the organizations were involved in offshore software development. Only a couple of them were just providing their services for the local clients. Results show that 88 percent organizations were involved in offshore software development as compared to only 12 percent which are totally focusing on local clients for their projects.

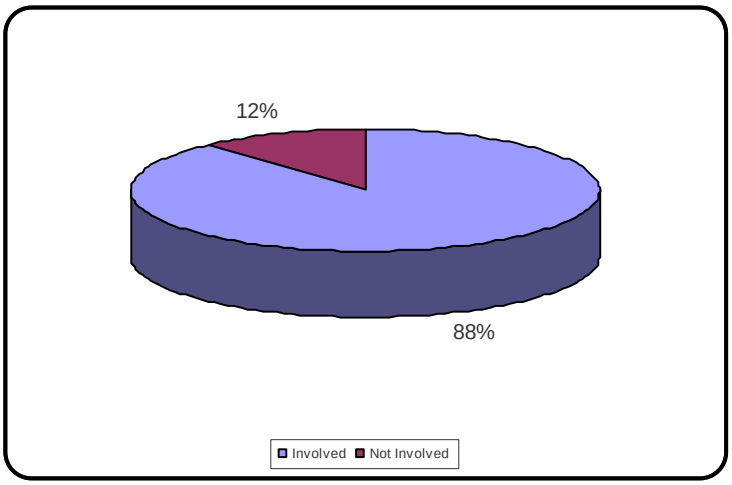

Figure 16. Organizations overall involvement in offshore software development.

The second question was concerning the overall project success ratio of the organization. In this question the organizations were asked about the number of projects done and the number of projects successfully completed during the last five year time period. Response of the organizations was quite positive, portraying that 84 percent of the projects have been successful during the last five years, while only 16% projects remained unsuccessful due to multiple reasons.

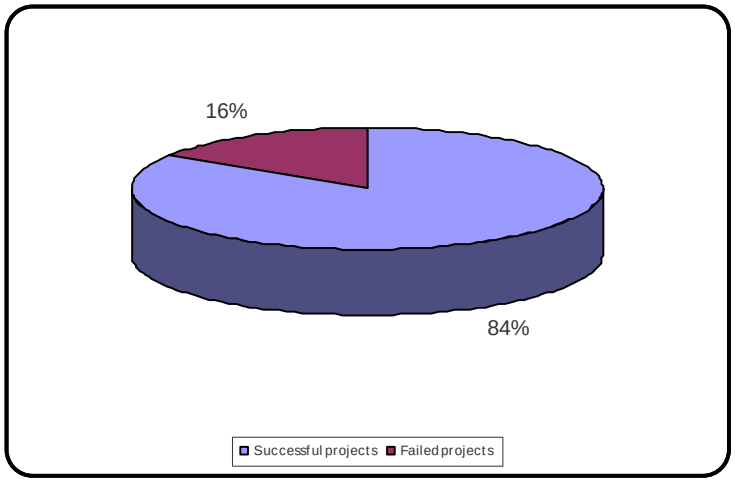

Figure 17. Organizations overall project success ratio in last 5 years.

The next question was on the subject of overall project success ratio in offshore software development during the last five year time period. In this question the organizations were asked about the number of offshore development projects done and the number of offshore software development projects successfully completed during the last five year time period. Response of the organizations was quite positive like the previous question, showing that 82 percent of the offshore software development projects have been successful during the last five years and around 18 percent offshore software development were unsuccessful.

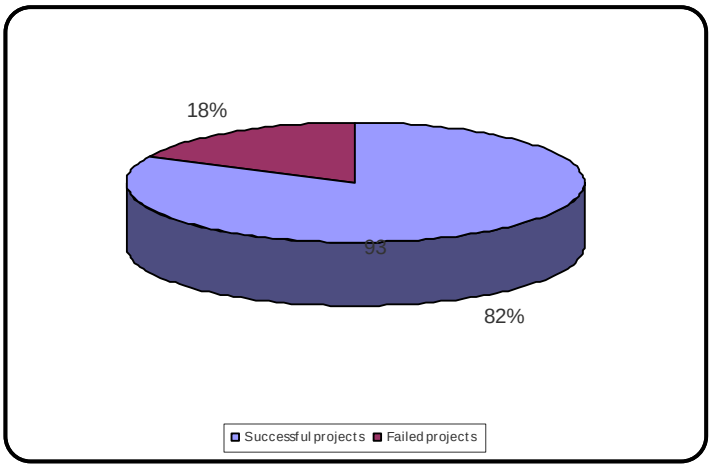

Figure 18. Organizations project success ratio for offshore software development.

Question four was regarding the number of projects outsourced by the organization and the number of successful projects during last five years. The percentage of successful projects is very high and very few projects have been unsuccessful during last five years. Survey results demonstrate that 83 percent of outsourced projects have been successful during the last five years as compared to 17 percent projects which failed due to some reasons.

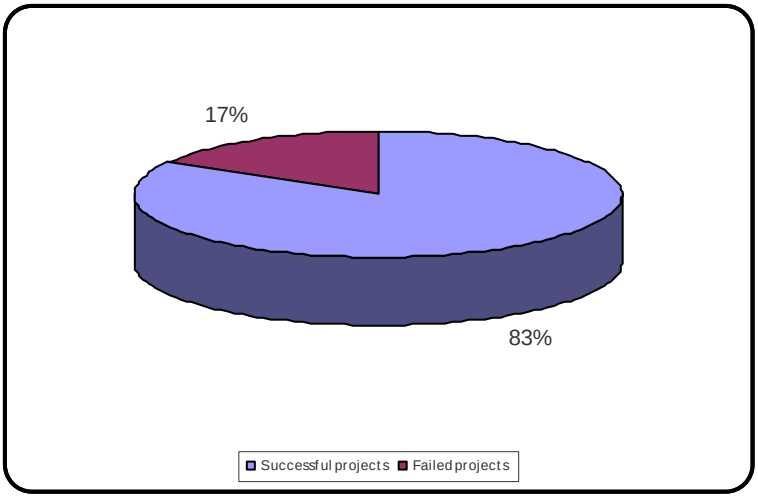

Figure 19. Organizations project success ratio for outsourced projects in last 5 years.

The fifth question was about the number of projects done and the number of projects successfully completed during the last couple of years. Response of the organizations was quite positive, depicting that 82 percent of the projects have been successful during the last two year time period while 18 percent projects have failed during the same time period.

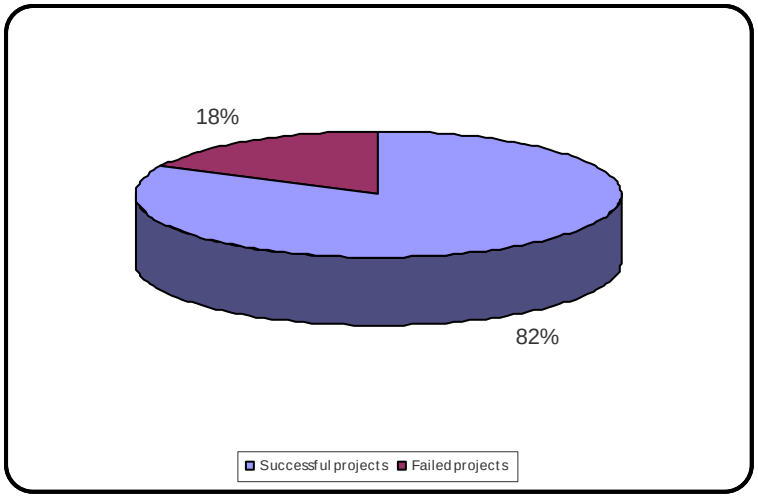

Figure 20. Organizations overall project success ratio in last 2 years.

Question six in the questionnaire was concerning the organization's overall project success ratio in offshore software development during the last couple of years. In this question the organizations were asked about the number of offshore development projects done and the number of offshore software development projects successfully completed during the last two year time period. Response of the organizations shows that around eighty five percent of the offshore software development projects have been successful during the last couple of years and 15 percent projects remained unsuccessful.

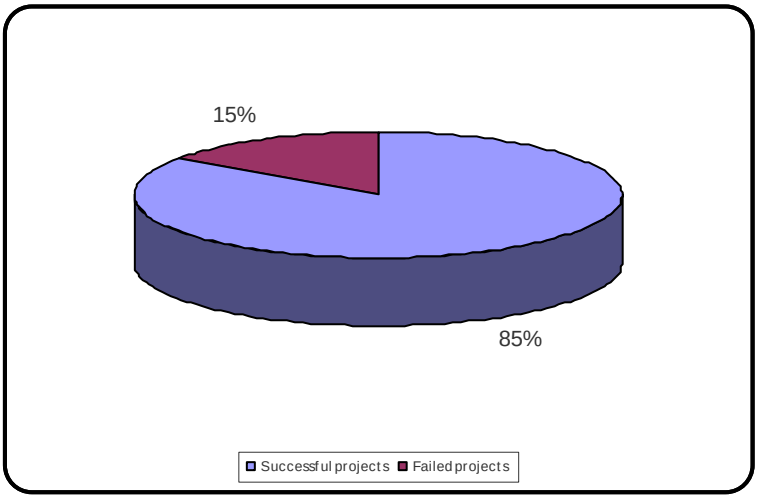

Figure 21. Organizations project success ratio for offshore projects in last 2 years.

Next couple of important questions were regarding the development of software project plan and formal software cost estimation for the offshore development projects. Responses for these questions were not satisfying because a limited number of organizations were developing software project plans for offshore projects. Although relatively more organizations were involved in software project cost estimation but very few of them were doing it formally.

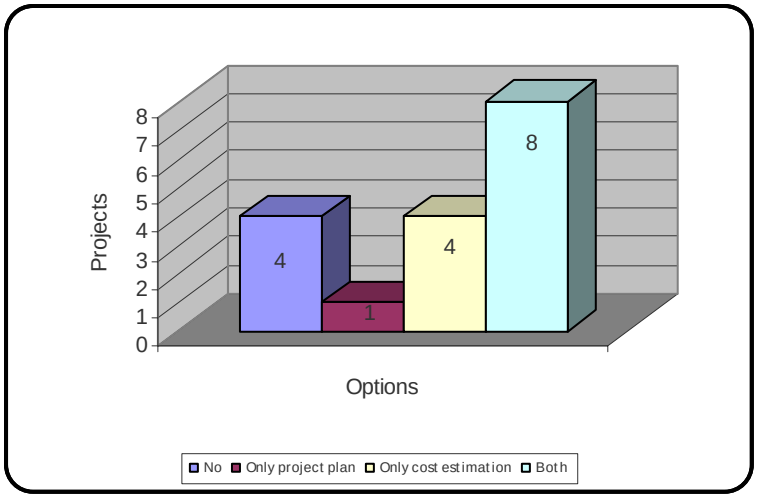

Figure 22. Development of project plan & formal cost estimation.

Survey results show that only 8 out of 17 organizations were developing software project plans and were carrying out cost estimation for offshore software development projects. There was only one organization which was developing software project plans but was not involved in cost estimation and there were 4 organizations which were not developing software project plans and were only involved in cost estimation of the offshore software development projects. The important thing to note here is that, there were 4 such organizations that were neither developing software project plans nor they were involved in any kind of formal cost estimation for offshore software development projects.

Another important question was regarding the software project management practices followed by the organizations for the offshore software development projects.

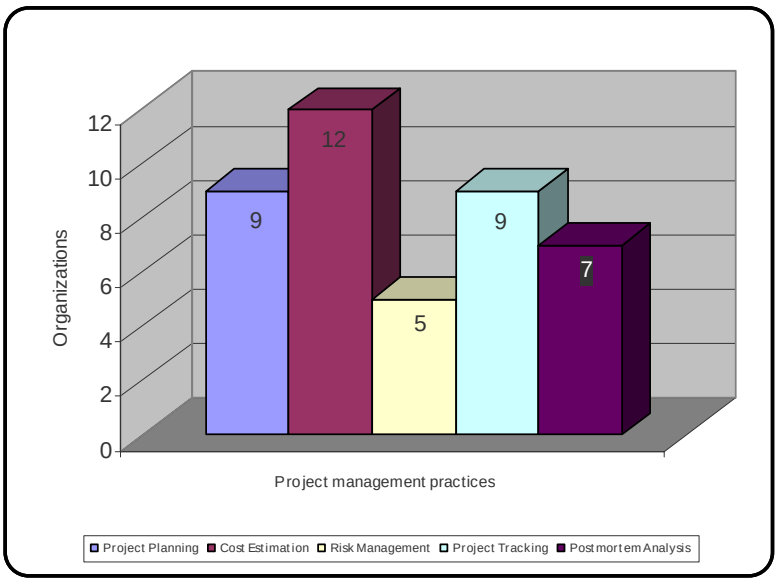

Figure 23. Project management practices followed in offshore software development.

A mixed response was received from the organizations for this question as some of the software project management practices were followed by most organizations but some critical practices were being followed by only a few organizations. Survey results show that only 9 out of 17 organizations were developing software project plans, 12 organizations were involved in cost estimation but all of them were not carrying it out formally, only 5 organizations were developing risk management plans, only 9 organizations were tracking and monitoring their offshore development projects and only 7 of them were conducting project postmortem analysis.

The tenth question was on the topic of the software process management practices followed by the organizations for their offshore software development projects. A mixed response was received from the organizations for this question as some of the software process management practices were followed by most organizations but some critical practices were being followed by only a few organizations. Survey results illustrate that only 6 out of 17 organizations were involved in process development activities, only a couple of them were applying bench marking, 13 organizations were implementing coding standards, 11 organizations were conducting reviews and inspections, all the organizations were doing software testing at some level and 15 organizations were having training for their resources.

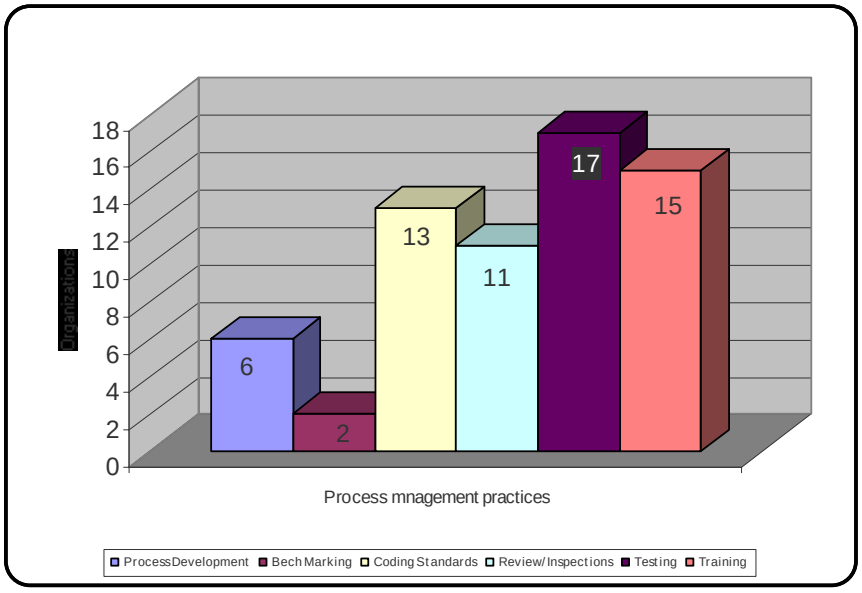

Figure 24. Process management practices followed in offshore software development.

Question eleven was regarding the data security issues faced by the organizations during offshore software development projects. Providentially very few data security issues were faced by the organization in last five years in background of offshore software development projects. Results depict that in 93 percent offshore software development projects no data security issues were faced while 7 percent projects involved some kind of data security issues.

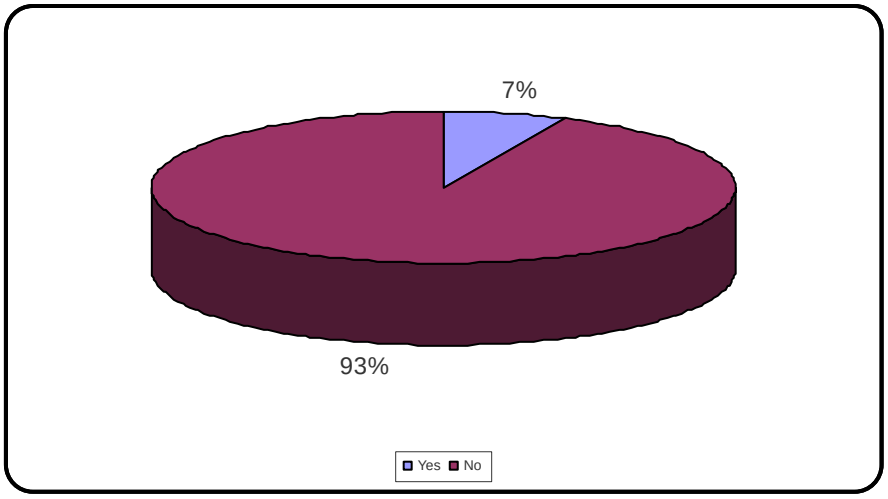

Figure 25. Data security issues faced in offshore software development projects.

Another important question was regarding the importance of constant interaction and communication, between the software organization and the client, for a successful offshore software development project. Results portray that 82 percent organizations have ranked this factor as highly important, 18 percent organizations have ranked it at intermediate importance and none have ranked this factor as least important.

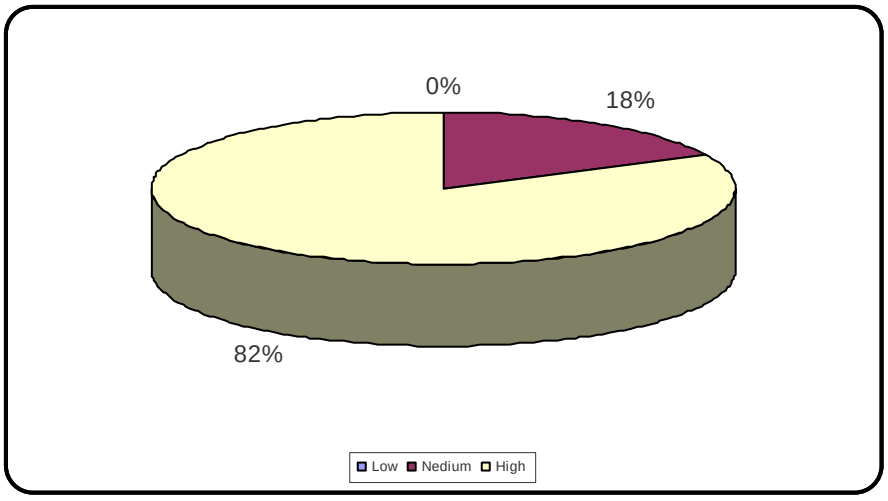

Figure 26. Importance of constant interaction & communication in offshore software development projects.

In the last question organizations were asked about some of the major issues that should be taken into consideration, by software organization and client, particularly in the context of offshore software development. Values are shown in relative percentages. Survey results show that time difference is given 49 percent importance, language differences are given 43 percent significance, cultural differences are considered as 47 percent essential, appropriate resource availability is ranked as 82 percent critical and resource skill level is considered as 84 percent significant before finalizing the offshore software development project.

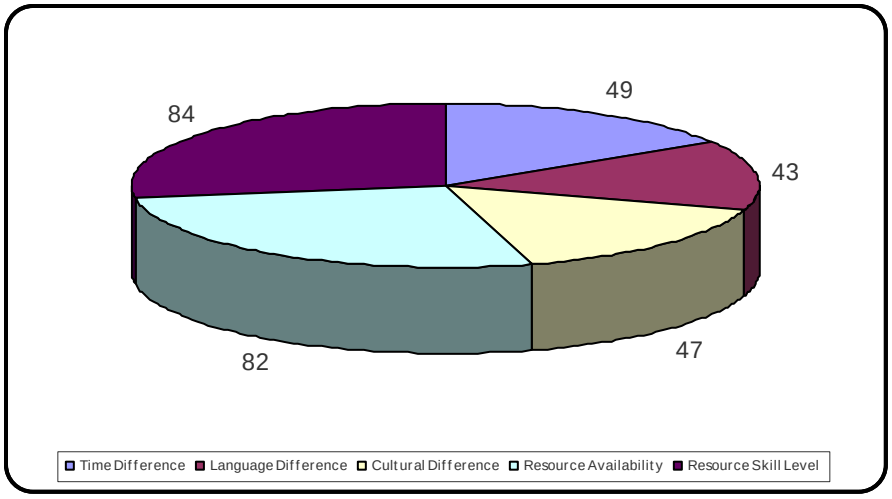

Figure 27. Issues to be considered before finalizing offshore s/w development project. (values in relative percentages)

With this the survey results of Questionnaire – A are complete and now I start presenting the results of Questionnaire – B. Questionnaire – B was quite brief and it contained only 3 questions. The objective of this questionnaire was to highlight those factors which play significant role in the success or failure of an offshore software development project. Factors having impact from 0% to 35% are considered as having least influence on failure, factors having impact from 36% to 75% are considered as having moderate impact and factors having more than 75% impact on failure are considered as having high influence on project failure.

In Questionnaire – B, the first question was regarding those factors that contribute significantly towards the failure of an offshore software development project. Survey results show that three factors, time differences, cultural differences and language differences are considered as having least influence on offshore software development project failure, as there impacts are 31%, 14% and 33% respectively. There are seven factors, resource skill level, lack of client management, lack of project tracking, lack of support by top management, lack of coordination with onshore team, commitment without developer consent and inappropriate communication mechanism, which have moderate influence on offshore software development project failure. The influences of these factors are 52% 69%, 69%, 52%, 60%, 69% and 64% respectively. Results also show that there are five factors, inappropriate cost estimation, lack of resource management, inappropriate project planning, inappropriate risk management and lack of requirement management, having high influence on the failure of an offshore software development project. The influences of these factors are 79%, 76%, 86%, 79% and 95% respectively. It is evident from the survey results that cultural difference has been rated as least significant and lack of requirement management as most significant factors for the failure of an offshore software development project.

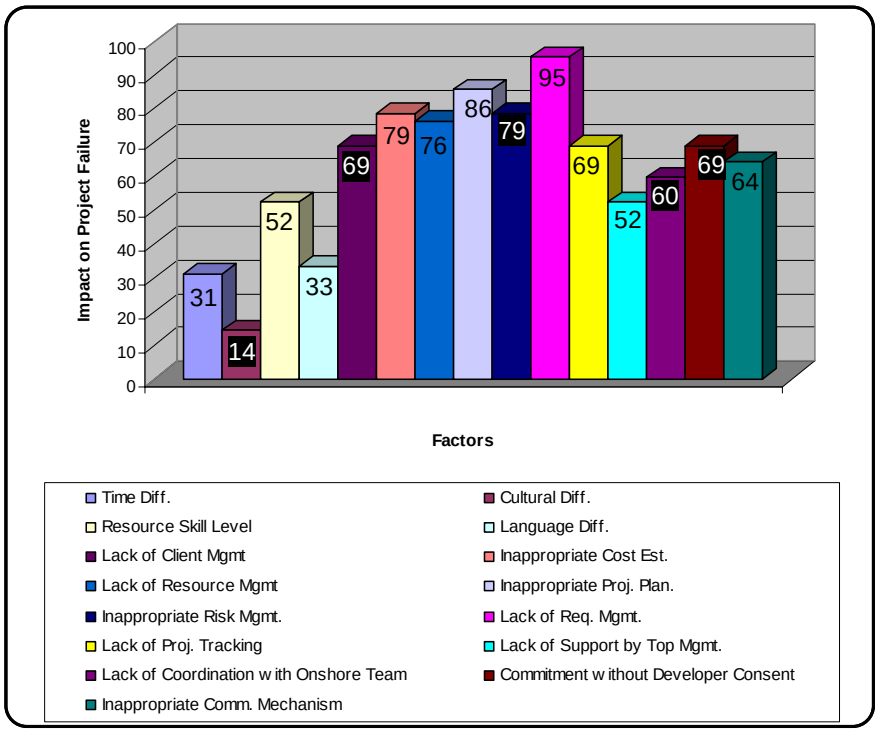

Figure 28. Factors having impact on offshore software development project failure.

Following issues have been highlighted by respondents for offshore software development project failure. Incorrect time estimation (high impact), disappearing of client (low impact), unseen requirements by client (moderate impact), negative or discouraging feedback from client (high impact) and client's lack of understanding of technologies used in the project (moderate impact).

The second question was regarding those factors which hold long term impact on project failures. These factors may or may not contribute significantly toward failure of one project but can have long term negative impact on the organization's project success ratio.

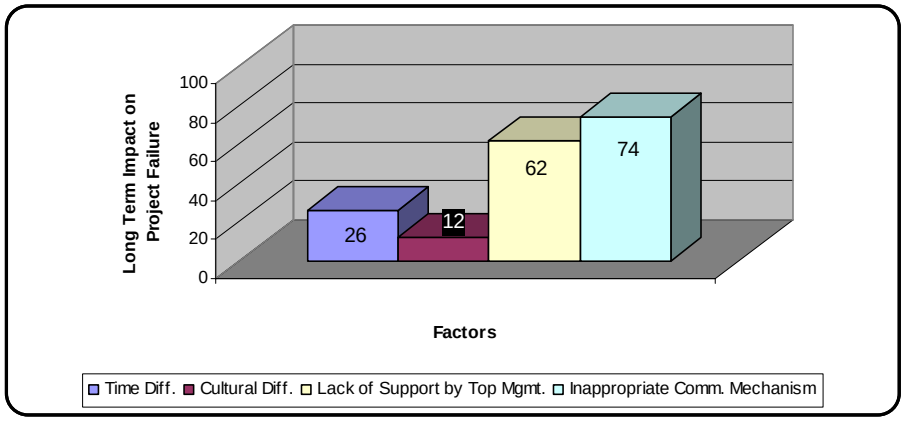

Figure 29. Factors having long term impact on offshore software development project failure.

Results show that time differences and cultural differences are once again rated as least significant with 26% and 12% long term impact on offshore software development project failure respectively. Lack of support by top management and inappropriate communication mechanism are rated as having moderate long term impacts on offshore software development project failure with 62% and 74%influence respectively.

Third and last question of Questionnaire – B was regarding the factors having significant impact on offshore software development project success.

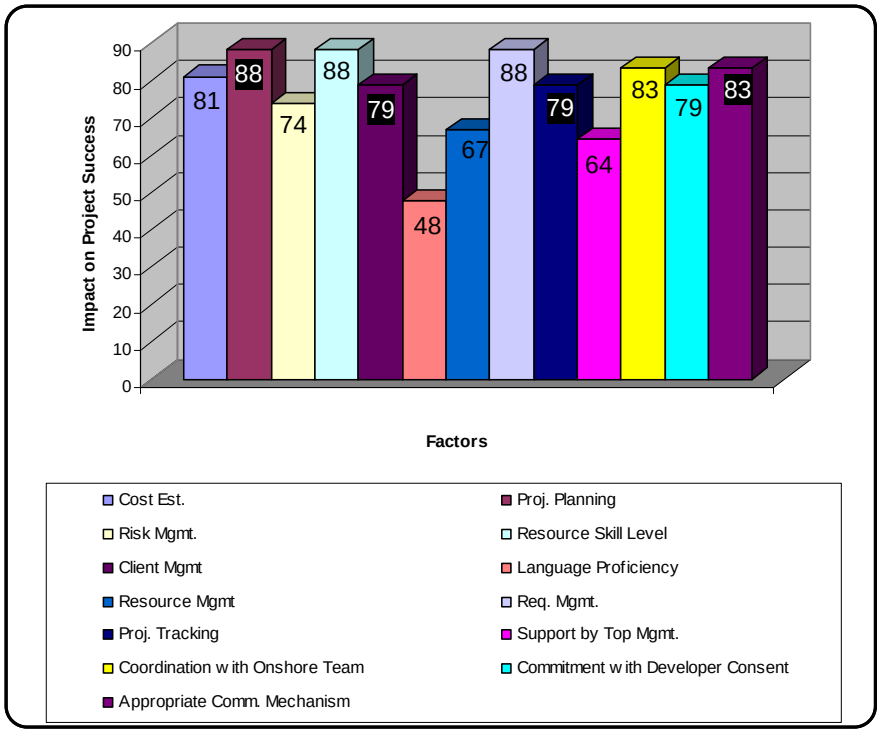

Figure 30. Factors having impact on offshore software development project success.

Survey results show that no factor has been considered as having least influence on offshore software development project success. There are four factors, risk management, language proficiency, resource management and support by top management, which have moderate influence on offshore software development project success. The influences of these factors are 74% 48%, 67% and 64% respectively. Results also show that there are nine factors, cost estimation, , project planning, resource skill level, client management, requirement management, project tracking, coordination with onshore team, commitment with developer consent and appropriate communication mechanism, having high influence on the success of an offshore software development project. The influences of these factors are 81%, 88%, 88%, 79%, 88%, 79%, 83%, 79% and 83% respectively. It is evident from the survey results that language proficiency has been rated as least significant where as project planning, resource skill level and requirement management as most significant factors for the success of an offshore software development project.

Chapter 5

DISCUSSION ON RESULTS

5.1 Survey Analysis

The section presents the analysis of the survey results and general discussion on them. The analysis has been carried out on the basis of the results attained from the survey. This analysis has been used in portrayal of the overall conclusion of this dissertation.

Survey results demonstrate that the mainstream of local software houses (Islamabad and Lahore) is involved in offshore software development. A percentage of more than eighty five looks quite healthy. An important point to be considered here is that organizations should not be too much focused on one side, i.e. by having some share in local as well as international market, they can diversify the risk. As we look in to the recent past, in late ninety's, many local organizations were flourishing and they were generating a lot of revenues, most of them, in fact their wide majority was too much focused on international market. But after nine eleven incident, when the doors of offshore software development were bunged and opportunities for getting international projects were squeezed, most of those organizations could not endure. The slump continued for almost two to three years and during this tough time those organizations which were not fully dependent on offshore projects but they also had some penetration in local market survived well. Thus organizations should diversify their risks by having some share in international as well as in local market. However the degree of involvement can and should be adjusted according to the circumstances.

Results also portray that the overall success ratio and the success ratio of offshore software development projects has been very good. It shows that the local software organizations have learnt from their mistakes and are trying to improve their quality standards. In order to contend in the international market particularly with offshore development giants like India, Russia, Israel, China and Ireland the key focus of our local software houses should be on quality. They should be striving to provide higher quality at lower costs. Only a successful

project is not enough but the real success is in retaining that customer and getting more and more business from him. Our local organization generally put their focus on projects instead of client. If client gets satisfied, a delayed project may not be a big concern. A contented customer is worth much more than a successful project with disgruntled customer. A satisfied customer can really generate continuous stream of business for the organization.

Success ratio of offshore software development projects has also been higher than eighty percent. It is a good indication but same as discussed earlier, focus should be on client instead of project. It does not mean just to ignore the project. An unsuccessful project will not give us a satisfied customer. Project has to be successful but project should be done in a way and client should handled properly so that he feels contented with the organization and feels comfortable in working with them. Only then he will get more business for the organization otherwise he may look for some other vendor. In the current scenario he will easily find some one due to high competition.

An alarming trend is that many organizations, in fact close to fifty percent, are not developing software project plans for their offshore software development projects. Without a proper software project plan it is not easily possible to handle projects. In offshore software development projects organizations usually settle some time frame with the client for each next deliverable, but as client is away and he cannot visit the organization so situation gets tough when the time limit for the deliverable is about to expire. Now everyone tries to do and to present something to the client but haste makes waste. In presence of a project plan, project can be run more smoothly and any slippages can be pointed out much earlier. Moreover, project plans also help in the estimation of future projects. The second thing is that many organizations do not carry out cost estimation for their offshore development projects. There are very few organizations which are carrying out proper cost estimation. Without proper cost estimation, projects are quoted just on the basis of personal hunches and intuitions. In highly competitive environment a petite oversight can lead to project loss, thus proper cost estimation should be carried out especially for offshore software development projects.

As far as project management practices are concerned, they need quite a bit of improvement. The most ignored part is risk management, as only five out of seventeen organizations are developing software risk management plans. As it has been discussed in details, in the literature survey, that there are more risks associated with the offshore software development project as compared to the normal projects, so risk management is indispensable for such projects. The next most ignored practice is project postmortem analysis. Project postmortem analysis helps the organization to learn from its mistakes and to perform better if they face similar situation in future. Software project planning and tracking are also done by only nine organizations out of seventeen. Without proper project planning the chances of success in a project are reduced significantly. Same is

the situation after developing the software project plan but not tracking and monitoring it. Project tracking and monitoring is as vital as project planning.

Response to the software process management practices is quite jumbled up, as no attention has been paid to process development and bench marking. In local software organizations the importance of process management has still not been recognized. Most of the organizations take it as extra burden and as non productive exercise. To some extent it is true, as efforts in software process management do not remunerate instantaneously but they certainly have their positive impact in the long run. India is having more organizations at CMM level 5 as compared to any other country in the world but still they can offer lower prices to their customers. Through process management, all the activities are streamlined and they contribute towards boost in overall efficiency and productivity. Survey response shows that local software organizations are paying proper attention on software testing and resource training. With proper software testing the overall cost of the project can be reduced because the cycles of development and redoing (correcting) same thing will be condensed to large extent. Without proper training organizations cannot compete in today's dynamic environment. Technology is changing very rapidly and in order to match its pace organizations have to provide proper training opportunities to its resources.

Another good outcome of this survey is that almost all organizations have cherished the importance of having a constant interface with the client in case of offshore development project. As mentioned earlier that, in case of offshore software development projects, client usually do not or cannot visit the offshore developer organization. So it is very important to have continuous interaction with the client. Few years back the communication cost was very high so some small scale organizations could not afford to communicate too often with their client but with recent development in telecommunication sector, the cost of communication has decreased rapidly so now even small scale organizations can easily afford to have a communication channel with their clients abroad. With continuous interaction clients feel comfortable and they can give their feedback instantly. So one can save a lot of time, of redoing the whole module, by constant interaction with the client and getting his feedback at different stages.

This survey also highlights the factors that have significant impact on the success and failure of an offshore software development project. Organizations need to overcome weaknesses like lack of requirement management, inappropriate project planning, inappropriate cost estimation, insufficient risk management and lack of resource management in order to minimize failures of offshore software development projects. All these factors are rated as having high influence on the failure of an offshore software development projects. By putting proper attention in these areas, organization's can significantly reduce their project failure ratio.

Finally, it is good to see that organizations pay attention to important issues before finalizing a project with the international client. Survey results confirm that local software organizations recognize the importance of critical issues like time differences, language differences, cultural differences, appropriate resource availability and resource's skill level. Proper attention on these issues can lead to success and at the same time organization can be straight away into nuisance if it finalizes and starts offshore software development project by ignoring any one of these critical issues.

5.2 Recommendations

On the basis of the above meticulous discussion, following recommendations have been finalized. These recommendations can be considered as the guidelines for the local software organizations eager to outrival in the meadow of offshore software development:

a. Local software organizations should not focus only on international projects but they should also penetrate in the local market and should develop some local clients in order to diversify their risk.

b. So far project success ratio has been quite healthy but efforts should be made not only to maintain this high ratio but to enhance it as well.

c. Efforts should be directed to get customer satisfaction without overlooking the project. The customer should be the main focus. Management should target more than one project, in fact continuous stream of work, from each client.

d. Project management practices should be pursued. Special consideration should be paid on project planning and tracking along with risk management. Project postmortem analysis also plays significant role but that should be the next step to project planning and tracking.

e. Software process management practices should not be ignored. Time, cost and effort spent in process management do not reimburse instantaneously but it is beneficial in the long run.

f. Constant interaction with the client is important for any project but it becomes even more significant in case of offshore software development. Client should be taken into confidence at every level of the project, so that he is sentient to the entire state of affairs.

g. Issues like time differences, language differences, cultural differences, appropriate skill availability and resource skill level must be considered acutely before finalizing any offshore software development project.

h. Practices like lack of requirement management, inappropriate project planning, inappropriate cost estimation, insufficient risk management and lack of resource management should be avoided, as they significantly contribute towards the failure of an offshore software development project.

i. Practices like project planning, resource skill level and requirement management should be kept in focus especially for offshore software development projects. These factors contribute significantly towards the success of an offshore software development project.

Chapter 6

CONCLUSION

6.1 Concluding Remarks

Offshore development is a rapidly growing practice in world economy because companies are under pressure to get products out or adjust their technologies at a rapid pace, without compromising their quality standards and internal resources. Our local software organizations should target this opportunity but there are few things that must be considered seriously beforehand.

Flaws of local software development are highlighted in offshore programming to a great degree and should be addressed by the buyer and the supplier in the initial stages of agreement. The prime focus of offshore development should be to avoid a disparity between expectations and deliverables. There can be problems with communication and understanding of requirements. It is even more important to document the requirements clearly, so that what is expected from the service provider is what is delivered. In addition to communication problems, it is very important for offshore service providers to understand their client's marketplaces and cultures. Moreover, offshore software development requires a methodology quite different from local software development. As in the case of offshore development client may not be able to visit the developers organization so there is need for effective communication to create a process that automatically keeps everyone in the loop. Modern technology has offered several alternatives for effective communication among remote teams.

The use of virtual teams in the construction of industrial software is becoming more and more commonplace as corporations seek to take advantage of lower costs and to utilize a 'follow the sun approach' to software development. Realities of global software development environment indicates that ease of use of technology, trust between the teams and well defined task structure influence positively the efficiency, effectiveness, and satisfaction level of global virtual teams. These parameters can be used by organizations to improve their quality and productivity. Moreover to avoid management oversights and to make it

easier to win business with international companies, offshore firms are also establishing a stronger international presence. The amount of coordination involved in offshore development leads to suggest that small offshore development projects should be avoided. It can take time to lay a solid foundation between partners, depending upon cultural differences, project complexities and technologies used. Thus longer projects or continuing maintenance contracts make better candidates for offshore development. Local software organizations need to show solid progress in software project management practices and software process management practices in order to meet the challenges by the offshore development giants like India, China, Ireland and Russia.

Following guidelines are useful for clients who are interested in doing business with offshore software development companies.

a. Find a good partner who has a proven record of offshore activities over a few years.
b. Choose suitable projects.
c. Possibly send a pilot project to the offshore company and evaluate the result.
d. Establish a long-term relationship.
e. Visit your development partner.
f. Establish good management practices.
g. Do not expect too much from the start. Offshore development is profitable in the long run, not for one time projects.

6.2 Limitations

Following limitations are associated with this research;

a. There are two main perspectives of offshore software development, client perspective and the developer perspective. In this dissertation more attention is paid on developer's perspective. Although client's perspective has been addressed in several sections of the document but the primary focus has been the offshore software developer.

b. Due to single person effort, responses of only seventeen local software organizations have been included in the survey. With a team effort or with access to some central authority same survey can repeated with a large number of respondents. Although the results of this portray some picture of current status of offshore software development but more comprehensive survey can be conducted in order to get more accurate information.

c. In the literature survey the primary focus has been on IEEE research papers, ACM research papers and white papers published by different organizations. A lot of valuable material is available in books published by different international publishers but due to their high prices and unavailability of those books in local market their knowledge has not been fruitful for this research.

d. Statistical techniques could not be applied to determine different types of relationships in characteristics and current offshore software development practices followed in local software industry. Large amount of data is required to apply statistical techniques and to get reliable results.

6.3 Future Work

In future the research work done in this dissertation can be extended in many ways:

a. A large scale survey can be conducted on country level to get deep information about the current offshore development practices in local software industry.

b. Client perspective of offshore software development can be more highlighted.

c. Statistical techniques can be applied on large amount of data collected through comprehensive survey to determine different type of relationships between different characteristics and local practices of offshore software development.

REFERENCES

[1] Steven M. Bragg; *Outsourcing – A Guide to Selecting the Correct Business Unit, Negotiating the Contract and Maintaining Control of the Process*; John Wiley & Sons, Inc. 1998.

[2] Ian Gouge; *Shaping the IT Organization*; Springer, 2003.

[3] Robert A. Day; *How to Write and Publish a Scientific Paper*; Cambridge University Press, 1993.

[4] Carmel, E.; *Global Software Teams*; Prentice-Hall, New Jersey, 1999.

[5] R. Heeks, S. Krishna, S. B. Nicholson, and S. Sahay; *Synching or Sinking: Global Software Outsourcing Relationships;* IEEE Software, March/April, 2001.

[6] Economic Times; *Go to India, China says Gartner*; May 5, 2002.

[7] L. Maciaszek; *Requirements Analysis and Systems Design: Developing Information Systems with UML;* Addison-Wesley, Toronto 2001.

[8] I. Sommerville, and G. Kotonya; *Requirements Engineering: Processes and Techniques;* John Wiley & Sons, Toronto, 1998.

[9] I. Gorton, and S. Motwani; *Issues in Co-operative Software Engineering Using Globally Distributed Teams;* Information and Software Technology, vol. 38, 1996.

[10] W. Kobitzsch, D. Rombach, and R. Feldmann, R; *Outsourcing in India*; IEEE Software, March/ April, 2001.

[11] Fitzgerald, G., & Willcocks, L.; *Contracts and Partnerships in the Outsourcing of IT;* Proceedings of the Fifteenth International Conference on Information Systems; Vancouver, BC, 1994.

[12] Marcolin, B.L. & McLellan, K.L.; *Effective IT Outsourcing Arrangements*; Proceedings of the 31st Annual Hawaii International Conference on System Sciences; 1998.

[13] Aubert, B.A., Patry, M., & Rivard, S.; *Assessing the Risk of IT Outsourcing*; Proceedings of the 31st Annual Hawaii International Conference on System Sciences; 1998.

[14] Caldwell, B.; *Partners: Genesis of a New Service Era*; Information Week; April 6, 1988.

[15] Garner, R.; *Anatomy of a Mega-Deal*; Computerworld; May 11, 1998.

[16] Cross, J.; *IT Outsourcing: British Petroleum's Competitive Approach*; Harvard Business Review; 1995.

[17] Huber, R.; *How Continental Bank Outsourced Its Crown Jewels*; Harvard Business Review; January/February 1993.

[18] Venkatraman, N. & Loh, L.; *The Shifting Logic of the IS Organization: From Technical Portfolio to Relationship Portfolio*; Information Strategy; 1994.

[19] Sharma, R. & Yetton, P.; *Interorganizational Cooperation to Develop Information Systems*; Proceedings of the Sixteenth International Conference on Information Systems*;* Cleveland, OH., 1996.

[20] Choudhury, V.; *Strategic Choices in the Development of Inter-organizational Information Systems*; Information Systems Research; March 1997.

[21] Chaudhury, A., Nam, K., & Rao, H.R.; *Management of IS Outsourcing: A Bidding Perspective*; Journal of Management Information Systems; 1995.

[22] Steiner, T.D. & Teixeira, D.B*.; Technology in Banking: Creating Value and Destroying Profits;* McKinsey & Co.; Illinois, 1990.

[23] Dewan, R., Seidmann, A., & Sundaresan, S.; *Strategic Choices in IS Infrastructure: Corporate Standards versus Best of Breed Systems;* Proceedings of the Sixteenth International Conference on Information Systems; Amsterdam, Netherlands, 1995.

[24] Technology Partners, Inc.; *Andersen Consulting Announces Outsourcing Agreement with Seven Insurers*; Technology Partners Sourcing; May, 1998.

[25] Marjanovic, S.; *Computer Associates Bid for CSC Seen as Bad News for Banks;* American Banker; February 23, 1998.

[26] Elliott, T.R.; *Vendor Shakeouts, Mergers and Strategic Alliances: The Impact on User Organizations*; Information Systems Management; 1987.

[27] Lacity, M., Willcocks, L. & Feeny, D.; *The Value of Selective IT Sourcing*; Sloan Management Review, 1996.

[28] Arrow, K.; *The Economic Implications of Learning By Doing*; Review of Economic Studies; 1962.

[29] Williamson, O.E.; Transaction Cost Economics: The Governance of Contractual Relations; *Journal of Law and Economics*; 1979.

[30] Chapais, B.; *Alliances as a means of competition in primates: Evolutionary, development, and cognitive aspects*; American Journal of Physical Anthropology; 1995.

[31] Clemons, E.K., Reddi, S. & Row, M.C.; *The Impact of Information Technology on the Organization of Economic Activity: The Move to the Middle Hypothesis*; Journal of Management of Information Systems; 9-25.

[32] Gurbaxani, V. & Whang, S.; *The Impact of Information Systems on Organizations and Markets*; Communications of the ACM; 1991.

[33] Malone, T.W., Yates, J. & Benjamin, R.I.; *Electronic Markets, Electronic Hierarchies: Effects of Information Technology on Market Structure and Corporate Strategies*; Communications of the ACM*;* 1988.

[34] Banker, R.D. & Kemerer, C.F.; *Performance Evaluation Metrics for IS Development: A Principal Agent Model*; Information Systems Research*;* 1992.

[35] Grossman, S., Hart, O.; *The Costs and Benefits of Ownership : A Theory of Vertical and Lateral Integration*; Journal of Political Economy*;* 1986.

[36] Hart, O.D. & Moore, J.; *Property Rights and the nature of the Firm*; Journal of Political Economy*;* 1990.

[37] Gresov, C.; *Exploring Fit and Misfit with Multiple Contingencies*; Administrative Sci*. Quarterly*; 1989.

[38] Berg, V., Duncan, J. & Friedman, P.; *Joint Venture Strategies and Corporate Innovation*; Cambridge, 1982.

[39] Duncan, N.B.; *Beyond Opportunism: A Resource-based View of Outsourcing Risk*; Proceedings of the 31st Annual Hawaii International Conference on System Sciences; 1998.

[40] Pfeffer, J.; *Power in Organizations*; Pitman Publishing, Marshfield, MA, 1981.

[41] Gomes-Casseres, B.; *Group versus Group: How Alliance Networks Compete*; Harvard Business Review; 1994.

[42] Porter, M.E. and Millar, V.E.; *How Information Gives You Competitive Advantage*; Harvard Business Review*;* July-Aug. 1985.

[43] Earl, M.J.; *The Risks of Outsourcing IT*; Sloan Management Review; 1996.

[44] Harrigan K. R., Newman W. H.; *Bases of Inter-organization Co-Operation: Propensity, Power, Persistence;* Journal of Management Studies*;* July 1990.

[45] Linder, J.C.; *Integrating Organizations Where Information Technology Matters;* Unpublished Ph.D. dissertation, Harvard University Graduate School of Business Administration, 1989.

[46] Loh, L. & Venkatraman, N.; *Determinants of IT Outsourcing: A Cross-sectional Analysis*; Journal of Management Information Systems; 1992.

[47] Grover, V., Cheon, M.J. & Teng, T.C.; *The Effect of Service Quality and Partnerships on the Outsourcing of IS Functions*; Journal of Management Information *Systems*; 1996.

[48] Jarillo, J.C.; On Strategic Networks; *Strategic Management Journal*; 1988.

[49] Strassman, P.; *Outsourcing: A Game for Losers*; Computerworld*,* August 21, 1995.

[50] Thomas M.Pigoski; *Practical Software Maintenance*; John Wiley & Sons, Inc, 1997.

[51] NASSCOM Report,; *The IT Software and Services Industry in India Strategic Review;* 2001.

[52] Information on Indian software industry from NASSCOM available at www.nasscom.org.

[53] Rao, H. R., Nam, K., Chaudhury, A.; Information Systems Outsourcing; *Communications of the ACM*; July 1996.

[54] Lauer, T.W.; *Software Project Managers' Risks Preferences*; Journal of Information Technology; December 1996.

[55] Barki, H., Rivard, S., Talbot, J.; *Toward an Assessment of Software Development Risk*; Journal of Management Information Systems; 1993.

[56] Roberts, L.; *Process Reengineering*; ASQC Quality Press, Milwaukee, Wisconsin, 1994.

[57] Linerooth-Bayer, J., Wahlstrom, B.; *Applications of Probabilistic Risk Assessments : the selection of Appropriate Tools*; Risk Analysis, 1991.

[58] Boehm, B.W.; *Software Risk Management: Principles and Practices*; IEEE Software, January 1991.

[59] Anderson, J., Narasimhan, R.; Assessing Implementation Risk: A Methodological Approach; *Management Science*, June 1979.

[60] Boehm, B, B.W.; *Software Risk Management*; IEEE Computer Society Press, Los Alamitos, California, 1989.

[61] Davis, G.B.; *Strategies for Information Requirements Determination;* IBM Systems Journal, Vol.21, No.1, 1982.

[62] Aubert, B.A., Patry, M., Rivard, S.; *A Tale of Two Outsourcing Contracts*; 1997.

[63] Earl, M.J.; *The Risks of Outsourcing IT*; Sloan Management Review; Spring 1996.

[64] Lacity, M.C., Hirschheim, R.; *Information Systems Outsourcing*; John Wiley & Sons, New York, 1993.

[65] Lacity, M.C., Willcocks, L.P., Feeny, D.F.; *IT Outsourcing: Maximize Flexibility and Control*; Harvard Business Review, May-June 1995.

[66] Cross, J.; *IT Outsourcing: British Petroleum's Competitive Approach*; Harvard Business Review, May-June 1995.

[67] Nelson, P., Richmond, W., Seidman, A.; *Two Dimensions of Software Acquisition;* Communications of the ACM, July 1996.

[68] Milgrom, P., Roberts, J.; *Economics, Organization & Management*, Prentice-Hall, New York, 1992.

[69] Williamson, O.E.; *The Economic Institutions of Capitalism*; The Free Press, New York, 1985.

[70] O'Leary, M.; *The Mainframe Doesn't Work Here Anymore*; June 1990.

[71] Klein, B., R. Crawford, Alchian, A.A.; *Vertical Integration, Appropriable Rents, and the Competitive Contracting Process*; *Journal of Law and Economics*, 1978.

[72] Wideman, R.M.; *Risk Management*, Project Management Journal, September 1986.

[73] Dorn, P.; *Selling One's Birthright*; Information*;* October 16, 1989.

[74] Eisenhardt, K.; *Agency Theory: An Assessment and Review*; Academy of Management Review, 1989.

[75] Roll,R.; *The Hubris Hypothesis of Corporate Takeovers*; Journal of Business, April 1986.

[76] Nam, K., Rajagopalan, S., Rao, H.R. Chaudhury, A.; *A Two-Level Investigation of Information Systems Outsourcing*; Communications of the ACM, July 1996.

[77] Alchian, A .A., Demsetz, H.; *Production, Information Cost and Economic Organization*; American Economic Review*,* December 1972.

[78] Barzel, Y.; *Measurement Cost and the Organization of Markets*; Journal of Law and Economics, 25, April 1982.

[79] Aubert, B.A.; *Outsourcing of Information Services: A Transaction Cost Analysis*; Ph.D. dissertation, École des HEC, Montréal, 1994.

[80] Prahalad, C.V., Hamel, G.; *The Core Competence of the Corporation*; Harvard Business Review, May-June 1990.

[81] Fine, C.H., Whitney, D. E.; *Is the Make-Buy Decision Process a Core Competence?;* Working Paper, MIT Center for Technology, Poliy, and Industrial Development, February 1996.

[82] Slaughter, S., Ang, S.; *Employment Outsourcing in Information Systems;* Communications of the ACM, July 1996.

[83] Conner, K.R.; *A Historical Comparison of Resource-Based Theory and Five Schools of Thought Within Industrial Organization Economics: Do We Have a New Theory of the Firm?;* Journal of Management, 1991.

[84] Holmstrom, B.R. and Tirole, J.; *The Theory of the Firm - Handbook of Industrial Organization;* Amsterdam: North Holland, 1989.

[85] Williamson, O.E.; *The Economic Institutions of Capitalism;* New York: The Free Press, 1985.

[86] Williamson, O.E.; *Markets and Hierarchies: Analysis and Antitrust Implications*; New York: The Free Press, 1975.

[87] Gurbaxani, V.; The New World of Information Technology Outsourcing; Communications of the ACM*;* July 1996.

[88] Duncan, N.; *Buying Core Competencies? A Study of the Impact of Outsourcing on IT Infrastructure Flexibility*; Proceedings of the First Americas Conference on Information Systems*;* August 1995.

[89] Nam, K., Rajagopalan, S., H. R. Rao, and Chaudhury, A.; *Dimensions of Outsourcing: A Transactions Cost Framework*; Managing Information Technology Investments with Outsourcing*;* Idea Group, 1995.

[90] Nam, K., Rajagopalan, S., Raghav Rao, H., and Chaudhury, A.; *A Two-Level Investigation of Information Systems Outsourcing;* Communications of the ACM ; July 1996.

[91] Applegate, L.M., McFarlan, F.W. and McKenney, J.L.; *Corporate Information Systems Management*; 4th Ed. Chicago: Irwin, 1996.

[92] Applegate, L.M. and Montealegre, R. Eastman Kodak Co.; *Managing Information Systems Through Strategic Alliances;* Harvard Business School; 1991.

[93] Barney, J.B.; *Strategic Factor Markets: Expectations, Luck, and Business Strategy*; Management Science; October 1986.

[94] Teece, D.J.; *Firm Boundaries, Technological Innovation and Strategic Management*; The Economics of Strategic Planning; Lexington Books, 1986.

[95] Wernerfelt, B.; *A Resource-based View of the Firm*; Strategic Management Journal*;* 1984.

[96] Barney, J.B.; *Firm Resources and Sustained Competitive Advantage*; Journal of Management; March 1991.

[97] Conner, K.R. and Prahalad, C.K.; *A Resource-based Theory of the Firm: Knowledge Versus Opportunism*; Organization Science*;* September-October 1996.

[98] Godfrey, P.C. and Hill, C.W.; *The Problem of Unobservables in Strategic Management Research;* Strategic Management Journal*;* October 1995.

[99] Amit, R. and Schoemaker, P.J.H.; *Strategic Assets and Organizational Rent*; Strategic Management Journal*;* January 1993.

[100] Collis, D.J.; *Research Note: How Valuable are Organizational Capabilities?;* Strategic Management Journal*;* Winter 1994.

[101] Kambil, A., Henderson, J., and Mohsenzadeh, H.; *Strategic Management of Information Technology Investments: An Options Perspective*; Managing Information Technology Investments with Outsourcing*;* Idea Group, 1995.

[102] Winter, S.G.; *Knowledge and Competence as Strategic Assets*; The Competitive Challenge; 1987.

[103] Shari Lawrence Pfleeger, and Barbara A. Kitchenham; Principles of Survey Research Part 1 – Turning Lemons into Lemonades; ACM SIGSOFT, November 2001.

[104] Shari Lawrence Pfleeger, and Barbara A. Kitchenham; Principles of Survey Research Part 2 – Designing a Survey; ACM SIGSOFT, January 2002.

[105] Shari Lawrence Pfleeger, and Barbara A. Kitchenham; Principles of Survey Research Part 3 – Constructing a Survey; ACM SIGSOFT, March 2002.

[106] Shari Lawrence Pfleeger, and Barbara A. Kitchenham; Principles of Survey Research Part 4 – Questionnaire Evaluation; ACM SIGSOFT, May 2002.

[107] Shari Lawrence Pfleeger, and Barbara A. Kitchenham; Principles of Survey Research Part 5 – Populations and Samples; ACM SIGSOFT, September 2002.

[108] Shari Lawrence Pfleeger, and Barbara A. Kitchenham; Principles of Survey Research Part 6 – Data Analysis; ACM SIGSOFT, March 2003.

Appendix A

LEADING OFFSHORE DEVELOPMENT SERVICES SUPPLIERS

The offshore trend is helping propel rapid growth in the IT economies of supplier countries. India and Ireland have been main beneficiaries of increased outsourcing by American firms. Among the other countries that are popular destinations for the outsourcing of software development work are Israel and Hungary. These countries provide a wide range of services for the industry, including some of the more sophisticated software development tasks. Other developing countries such as China, Vietnam and the Philippines are increasingly getting involved, particularly at the lower end of activities.

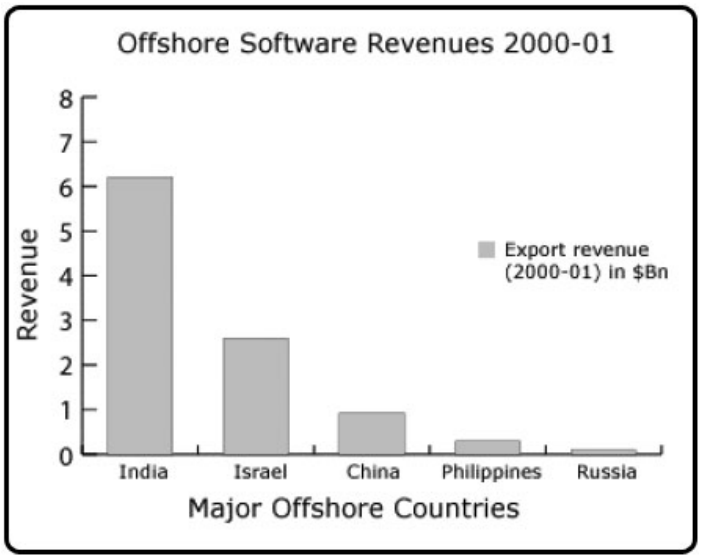

Figure 31. Leading offshore software development countries 2000-01.

A.1 India

In India, easily the biggest provider of offshore development, IT exports have grown more than 55% a year for the past five years and are expected to reach $50 billion by 2008, according to a report McKinsey & Co. published last December. In the export market, India's expertise in Professional Services and Customized Software are expected to continue their dominance as a major part of Indian software export activity. The six OECD countries (USA, Japan, UK, Germany, France and Italy) together have 73% of the market share of the worldwide software market. Interestingly, India's export to these countries is also almost 83% of its total software exports. In the coming years, India is expected to strike many joint ventures and strategic alliances in Europe.

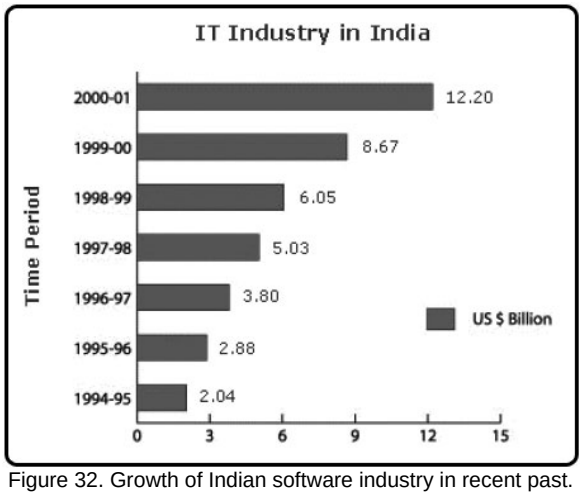

Figure 32. Growth of Indian software industry in recent past.

The IT industry in India has grown from a meager $2.08 billion in the mid 90's to $12.2 billion in 2000-01. India has been one of the prominent exporters of software and America accounts for 62% of the exports.

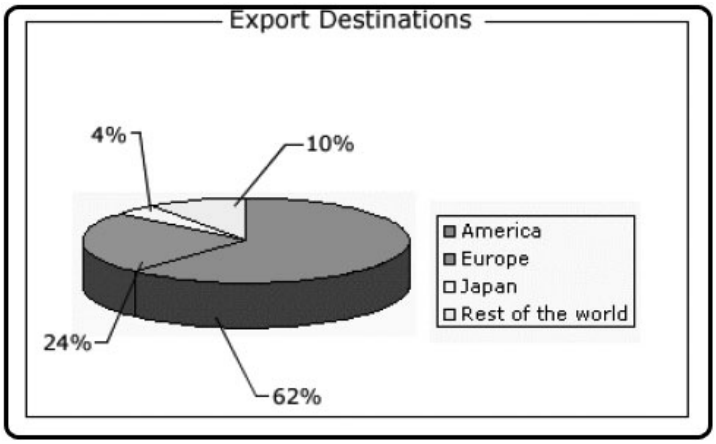

Figure 33. Indian export destinations.

According to research firm IDC, India, with its solid infrastructure, widespread fluency in English and vast pool of IT talent, is best placed to control the largest portion of offshore outsourcing funds. A NASSCOM-McKinsey (1999) study also states that India is best positioned for cross-border IT services.

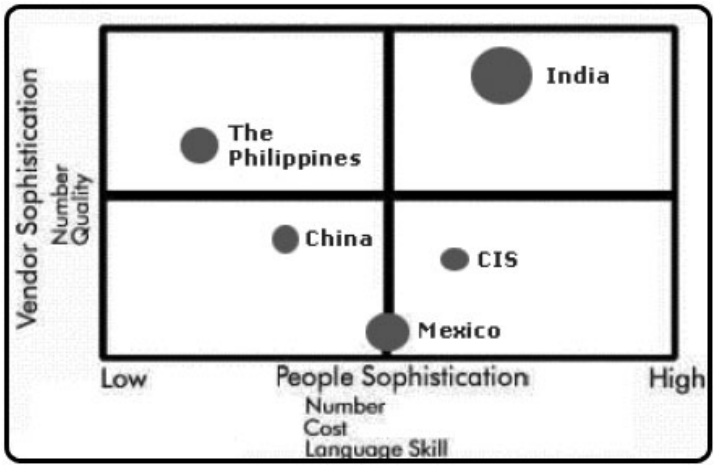

Figure 34. India's position in offshore development industry.

Apart from India, many other countries are also getting into the offshore act. According to IDC, Mexico's offshore IT income will surge more than 80% to $30 million this year. Besides this, IT expansion is also taking place in many European countries like Bulgaria and Slovenia. Russia has also proved to be a good source of IT talent. Russia's annual revenue from offshore activity is between $60 million and $100 million per year, growing at 40% to 60% annually.

A.2 Ireland

Ireland has become the largest exporter of software globally. It is recognized as the premier location for software development in Europe. Major multinationals like Microsoft and Oracle have used Ireland as a base for their European market. Along with this a thriving indigenous software industry has emerged which is export oriented and increasingly product based. The Irish software industry spans a wide range of market segments due to the broad base of companies in the sector. It has particular strengths in systems software and middleware, insurance and banking applications, telecommunication software, e-learning and healthcare.

At the end of 2003, it was estimated that the Irish software industry consisted of more than 900 companies, 140 of them foreign, employing 24,000 people and exporting over €14bn worth of products and services. Irish companies account for almost €1.1bn of that.

Year	Irish	Overseas	Total
1991	78	1,966	2,044
1993	147	2,192	2,339
Growth 1991-1993	88%	11%	14%
1995	287	3,282	3,570
Growth 1993-1995	95%	50%	53%
1997	455	4,981	5,436
Growth 1995-1997	58%	52%	52%
1998	566	5,293	5,860
Growth 1997-1998	25%	6%	8%
1999	792	5,728	6,520
Growth 1998-1999	40%	8%	11%
2000	875	7,625	8,500
Growth 1999-2000	10%	33%	30%
2001	1,228	10,968	12,257
Growth 2000-2001	47%	43%	44%
2002	1,313	11,689	12,997
Growth 2001-2002	2%	7%	6%
2003	1,102	13,261	14,363
Growth 2002-2003	- 16%	13%	11%

Figure 35. Irish IT software and services exports 1991-2003 (Values in Euros).

A.3 Israel

Israel's software industry is one of the world's premier centers of innovation and entrepreneurship. In July 2000, Wired Magazine named Israel one of the world top venture capital and high technology centers. Israel's domestic software market is small and highly competitive, so most of the companies are export oriented and have developed an international outlook from the start. The firms range from giants like Checkpoint who earn billions in revenue to small firms who earn a million or so. But the most striking aspect of the Israeli software industry is it's being product-based and the high level of research and development taking place.

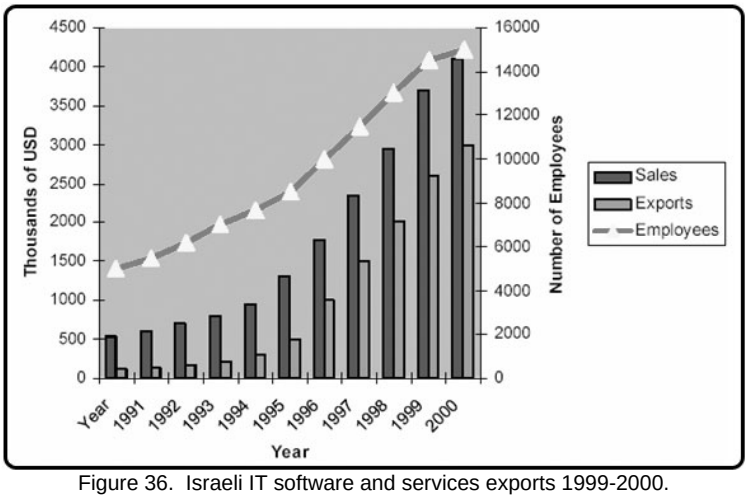

Figure 36. Israeli IT software and services exports 1999-2000.

In 2002, electronics and information industries employed approximately 54,800 people of whom 63% were scientists, engineers, and technicians. The combined sales of the electronics and information sectors was $12.5 billion of which $10.1 billion was earned from exports.

In 1991, total Israeli software sales were approximately $540 million of which 20% was exported. At the time, software firms employed 5,000 people. At the end of 2001, the Israeli software sector had approximately 400 active firms that employed approximately half of the 35,000 computer professionals in the country.

A.4 China

China's software industry has a domestic focus. China has a large domestic market for software. Most firms are providing IT solutions implementation and IT operation services to domestic market. Other areas of activity are localized software, embedded software, and providing services for the corporate sector. Its domestic IT market was US$16.3 billion in 2001. Hardware sales constitute 85% of this revenue. Keeping in view China's recent development in other industrial sectors, the IT industry in general holds the promise to compete head on with India one day.

The basic structure of China's software industry consists of a mixture of product firms (which also offer some low and high level services), and low-level service firms. The industry has strong government support, especially in R&D and entry of global IT majors. Government also purchases software to boost demand (e-government, hospital information systems, smart schools and distance learning etc.). Government has also simplified registration of firms and listing on stock exchanges, redesigned the IT curriculum of universities, encouraged software firms to fund research programs in universities, and rewards research facilities that successfully commercialize their research. Japan is off shoring R&D and IT services to China, due to geographic proximity and Japanese language competency in parts of China.

	Software products	Services	Exports	Total
1999	182	239	21	442
2000	238	322	33	593
Rate of growth (%)	*31.8*	*35*	*57*	*34.3*

Figure 37. Chinese IT industry's sales breakdown (million Yuan).

China has captured almost 30% of all foreign direct investment in developing countries. Only about 5.6% of China's software industry output was export-based in 2000. About one third of China's industry was product-based in 2000. In 2000, out of product sales of 23.8 billion Yuan, packaged software products were reported to be about 1.5 billion Yuan. This only represents direct sales by computer retailers, which are estimated to be about 10 to 15%of the actual total. Of this packaged software, about 65% of the sales come from application products, 21% from supporting software and 14% from system software. The statistics about IT professionals present in China and those graduating per year are given below. Beijing is the largest software producing district. Its software industry includes packaged, industrial, and security software, as well as exports. Beijing's is a centre for government and leading educational and research institutions, as well as a number of well-known computer firms. Shanghai has fewer companies but attracts lot of overseas investment, finance, and high-tech industries, including electronics and semiconductors. The infrastructure, universities and government support in Shanghai are also strong.

Appendix B

MAJOR IT ORGANIZATIONS IN PAKISTAN

B.1 Ministry of Information Technology

Ministry of Information Technology (MoIT) is the national focal Ministry and enabling arm of the Government of Pakistan for planning coordinating and directing efforts to initiate and launch Information Technology and Telecommunications programs and projects aimed at economic development of the country. The national focal point for Information Technology (IT) which was previously either missing or diffused was rectified with the creation of a new Information Technology and Telecommunications Division in March, 2000 under Ministry of Science and Technology (MoST). All Telecom and IT related organizations have been placed under this Division. The MoST was constituted of two divisions i.e. Science and Technological Research Division (S&TR) and IT & Telecom (IT&T) Division. The S&TR Division is focused on Science and Technology areas other than IT & Telecommunications. In November 2002, a separate Ministry for Information Technology was created and IT & Telecommunications Division became a part of the Ministry of Information Technology (MoIT). The principal agenda of the Ministry of Information Technology (MoIT) is building Pakistan's Information Technology competency in the twenty first century. The major objectives are: Transformation to Electronic Government, Development of Software Industry, Building a state of art Infrastructure and Development of a qualitative pool of Human Resource. The Ministry of Information Technology (MoIT) is working on the national agenda to have a sound and sustainable Information Technology and Telecommunications base which will result in the socio economic development of the country and the attainment of the vision for a better Pakistan. The Ministry is maintaining consistency with the policy and achievements made in the IT & Telecommunications sector since its inception and to cope with modern challenges and meeting requirements of the IT and Telecommunications, the policy is regularly updated.

IT & Telecommunications Division Introduction Looks after all aspects of policy planning and implementation regarding information technology and telecommunications at the national level. Objectives Preparation of an overall integrated plan as well as formulation of the policy for the development and improvement of information technology including infrastructure Human resource development in the field of information technology. Promotion of IT applications Providing guidelines for the standardization of software and electronic governance within the Government Planning and policy making and legislation covering all aspects of telecommunications excluding radio and television.

Ministry of Science and Technology has following major functions;

a. Preparation of an overall integrated Plan as well as formulation of policy for the development and improvement of Information Technology including infrastructure in Pakistan.

b. Cooperation with the provincial Governments, autonomous bodies, private sector, international organizations and foreign countries in respect of information Technology.

c. Promotion of information Technology applications.

d. Providing guidelines for the standardization of software for use within the Government.

e. Matters relating to Pakistan Computer Bureau, Pakistan Software Export Board and the National Information Technology Commission.

f. Planning, policy making and legislation covering all aspects of Telecommunications excluding radio and television.

g. All matters relating to PTCL, FAB, NTC, TIP, CTRL, CTI, Telecom Foundation and the Special Communication Organization and NRTC

h. All matters relating to Pakistan Computer Bureau and Petroman.

B.2 Pakistan Software Export Board

Pakistan Software Export Board (PSEB) was incorporated in 1995 with the aim to facilitate local IT industry in development and export of software. Since its inception, PSEB is bridging the gap of international and local IT industry by assisting them in general and particularly in Software Development, Data Communication facility, establishment of Software Technology Parks (Islamabad, Lahore, Karachi, Peshawar) and Call Center operations. Overview In a rapid

growth environment it is essential to coordinate activities to achieve maximum benefit. Pakistan Software Export Board, as the official promotional agency of the Government of Pakistan, is helping to fulfill this role by actively enhancing the image of the local Information Technology industry. PSEB is helping to promote local IT companies in the international market as well as assisting development in the local forum to encourage growth of this sector. Our member companies are working with some of the leading corporations around the globe, many having clients from Fortune 500 companies. The quality standards offered by Pakistan are second to none with many companies following ISO 9001 standards. With PSEB and its dynamic leadership, software exports have grown more than 60% since 2001. Our broad range of services is helping companies from all over the globe to setup, merge and outsource their IT needs to Pakistan successfully and benefit from their sound decision to choose Pakistan to serve as their IT hub in the region. Major Functions To operate as “in-action” facilitator that caters for all needs of IT entrepreneurs from setting up a company to facilitation in finding business ventures.

To develop a visionary, multi phased marketing plan to support local IT industry tap the virgin IT consumer markets by participating in worldwide mega IT exhibitions. Offering lucrative investment incentives to multinational companies in setting up offshore offices in Pakistan. To instigate different domestic projects to make provision for the sustainability of local IT industry. To conduct IT research and development analysis study in Pakistan for strategic Governmental level policies. To act as a ONE STOP shop to cater to all needs of a “IT Company” for setting up or facilitating its business ventures. To plan, develop and establish the “Information Technology Parks” and to provide space, international data communication links as well as uninterrupted electric power to IT Companies setup in these parks. To develop and execute a marketing plan to help local software companies reach out to potential clients abroad, attract and facilitate foreign software firms to establish their software development facilities in Pakistan. To facilitate projects between the Pakistani educational institutions and the computer industry to bridge the gap between academia and the industry. We understand the needs of the modern day IT industry and therefore strive to provide the best possible services to all software related companies. We have worked closely with many companies in developing educational plans that prepare the future IT students for the needs of this continuously evolving industry.

Programs PSEB is undertaking following programs.

a. ISO Certification To bring 80 IT companies achieve ISO 9001:2000 certification.

b. Domestic Exhibitions To facilitate local industry to interact with international companies in local mega exhibitions thrice a year on subsidies rates.

c. Entrepreneurs Development Providing facility to groom new entrepreneur's developing products sellable in international market.

d. Internships Linking of academia & IT industry by placing fresh IT graduates into local IT industry.

e. Automation of Domestic Manufacturing Industry To automate 100 small & medium enterprises to increase productivity as well as for sustainability of local IT industry.

f. Data Network Node Providing reliable high-speed connectivity in STPs.

g. Info Center To set up IT libraries, IT Pavilions and Advisory Council free for local IT professionals.

h. International Exhibitions International exhibitions To facilitate local IT industry to participate in 3 mega international exhibitions yearly on subsidied rates. The Software Technology Parks (STPs) for Islamabad, Karachi and Lahore have been conceived as one-stop shop for all software houses which seek working conditions conducive to creativity, inexhaustible bandwidth and power supply, minimum regulatory overheads, maximum flexibility in the choice and use of space and minimal costs. The project companies which had built and administering these ITPs have ensured that all these facilities are available with the barest minimum hassle to the software houses themselves.

B.3 Electronic Government Directorate

In October 2002 the Electronic Government Directorate (EGD) was established in pursuance to a decision of the federal cabinet. EGD has been formed by converting the former Information Technology Commission. EGD is a department of Ministry of Information Technology and Telecommunications. The T.O.Rs of EGD are: To undertake Implementation of different projects related to the Electronic Government (E-Govt) Programme. Provide technical advice & guidelines for implementation of E-Government projects at the federal, provincial and district levels; Plan and prepare electronic Government projects. Provide standards for software and infrastructure in the field of electronic Government; and Any other assignment matter that the Government may direct. One of the cardinal principles laid down in our IT Policy and Action Plan, approved by the Government of Pakistan in August 2002, is that Government will be an enabler and facilitator in the field of Information Technology. EGD, by following this principle, farms out different e-Government projects that are to be implemented by it. So far different projects worth Rs.90 Million have been awarded to 20 IT entities in the private sector. In view of the EGD role model mentioned above the Directorate is a small work unit comprising IT professionals who have been engaged at market rates of remuneration for a two-year period. The contracts are

renewable depending on satisfactory performance. EGD, headed by the Programme Coordinator, consists of the Director General (Projects), as incharge of all technical aspects of EGD. He supervises the work of five technical directors.

The five technical directors have expertise in the following areas:

a. Web development/administration

b. Communications & Security

c. Networking

d. Databases

f. System Analysis and Software Development

Their functions are to, undertake constant research and study to gain latest IT knowledge especially in the field of e-Government. To prepare standards, guidelines for guidance of various agencies. To prepare business proposals of e-Government projects for seeking approval of Government. To supervise and monitor projects those are outsourced. A dedicated team of seven experts is also working in EGD for updating and upgrading of Pakistan.Gov Web Portal. This very team of experts helped the developers in preparation and launching of the Portal.

B.4 Pakistan Software Houses Association

Pakistan Software Houses Association (PASHA) was formed in the last quarter of 1992 by nine software houses. By 2003, PASHA had grown to over 200 members. Its main objective is to promote and develop the software and services industry in Pakistan and to protect the rights of its members. The software and services industry is growing at an enormous pace in Pakistan and PASHA, along with its members, is playing an important role in making their presence felt, both nationally and internationally.

a. To provide a platform for member software and service companies to share technical and management related experience.

b. To promote, protect and develop the software and services industry in Pakistan.

c. To provide a forum for formulation of standards for the software and services industry in Pakistan.

d. To provide a focal point for outside agencies such as end-user organizations and foreign trade/donor agencies etc, to contact for queries related to accredited software and service companies and the general state of affairs of information and communication technology in Pakistan.

e. To solicit support such as subsidized communication facilities and relaxation of Government policies from GOP.

f. To devise ways and means for tackling and solving the problems & difficulties confronting the members & allied industries/ trades.

g. To collect, tabulate and circulate statistics & other information relating to or of interest to the business of its members &/or the industry in general.

h. To publish, or cause to be published, or encourage and support publication, bulletins or any other information useful or beneficial to the member companies and the industry in general.

i. To initiate, protect, promote and support legitimate interest of the members, including those necessary for and in the interest of Pakistan and to take steps to secure public support against measures affecting the software and services industry.

j. To make representations to and communicate with Federal, Provincial Governments, Local or other authorities both Government & Private on any matter affecting the business of its members or of its trade.

k. To secure, organize and coordinate action on all matters pertaining to or affecting the interests of its members.

l. To endeavor to settle, adjust and resolve controversies between members and to arbitrate in matters of differences or disputes arising between members.

m. To frame, vary, modify and/or amend, from time to time, the arbitration rules of the Association.

n. To undertake special investigative study, research and enquiries.

o. To hold in trust, in safe custody or otherwise except for the purpose of trading any material or amount desired to be so held by the Government or members of the Association.

p. To advise and assist the Government in the formulation of useful and progressive policies and to cooperate with them in their successful implementation.

q. To take effective measures to eradicate unethical practices in the field of trade, commerce and industry.

r. To subscribe to and become a member of the Federation of Pakistan Chambers of Commerce and Industry and to cooperate with and/or to procure from and communicate with any incorporated organization of trade, commerce and industry such information as may be likely to further the aims and objects of the Association.

s. To frame and assist in the framing of rules of practice for facilitating and simplifying the business of its members.

t. To maintain and manage any training facilities which may be set up by the Association with or without the assistance of the Government.

u. To encourage friendly feelings, close cooperation and unanimity among the members of the Association on all matters connected with their common goals and objectives. Only in connection with the activities & operations of the Association, to purchase, take on lease or in exchange or otherwise acquire or deal in and to construct, maintain, develop or control lands, buildings, or any kind of movable or immovable property or any rights or privileges connected with such property or properties.

v. To sell, improve, manage, develop, exchange, lease, mortgage, dispose off, turn to account or otherwise deal in all or any part of the property of the Association.

w. To invest and deal with the money of the Association not immediately required in such manner as may, from time to time, be determined. And generally to do all that may be conducive or necessary to achieve and attain all or any of the aims and objects of the Association directly and indirectly.